Nature

17.11.05

Задача 6.

ш) $a_1 = 8$

$d = 3$

$n = 14$

$a_n - ?$

$a_n = a_1 + (n-1)d$

$a_{14} = 8 + 13 \cdot 3 = 47$

е) $a_1 = -220$

$d = 50$

$n = 7$

$a_n - ?$

$a_n = a_1 + (n-1)d$

$a_7 = -220 + 6 \cdot 50 = 80$

я) $a_1 = 120$

$d = 2/5$

$n = 21$

$a_{21} - ?$

$a_n = a_1 + (n-1)d.$

$a_{21} = 120 + 20 \cdot \frac{2}{5} = 128$

ю) $a_1 = 45$

$d = 5/2$

$n = 41$

$a_{41} - ?$

$a_n = a_1 + (n-1)d.$

$a_{41} = 45 + 40 \cdot \frac{5}{2} = 145$

№ 7

$a_1 = 2$

$a_3 = 3$

$a_2 - ?$

$$\begin{cases} a_2 - a_1 = d \\ a_3 - a_2 = d \end{cases} \Rightarrow \begin{cases} a_2 - a_1 - a_3 + a_2 = 0 \\ 2a_2 = a_1 + a_3 \end{cases}$$

$$a_2 = \frac{a_1 + a_3}{2}$$

$$a_2 = \frac{5}{2} = 2{,}5$$

№ 8.

$a_1 = 2$

$a_5 = 3$

$a_2 - ?$

$a_3 - ?$

$a_4 - ?$

$$a_3 = \frac{a_1 + a_5}{2} = 2{,}5$$

$$a_2 = \frac{4{,}5}{2} = 2{,}25$$

$$a_4 = \frac{5{,}5}{2} = 2{,}75$$

Ответ: ~~2; 2,5;~~

2; 2,25; 2,5; 2,75; 3

№ 9

$a_1 = 0$

$a_9 = 7$

$a_2; a_3; a_4; a_5$

$a_6; a_7; a_8 - ?$

$$a_n = a_1 + (n-1)d$$

$$a_9 = a_1 + (9-1)d$$

$$7 = 0 + 8d$$

$$d = \frac{7}{8}$$

$a_2 = a_1 + d = \frac{7}{8}$

$a_3 = \frac{14}{8}$

$a_4 = \frac{21}{8}$

$a_5 = \frac{28}{8}$

$a_6 = \frac{35}{8}$.

$a_{11} = 67$

$a_{25} = 158$

$a_n = 93$

$n - ?$

2 ур. с. 10

$$\begin{cases} a_{11} = a_1 + (11-1)d \\ a_{25} = a_1 + (25-1)d \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} 67 = a_1 + 10d \\ 158 = a_1 + 24d \end{cases} \Rightarrow 14d = 91$$

$d = \frac{91}{14} = 6{,}5.$

$a_1 = a_{11} - 10d$

$\left(a_1 = 67 - \frac{455}{7} = \frac{589-455}{7} = \frac{134}{7}\right)$ *

$a_1 = 67 - 65 = 2.$

$a_n = a_1 + (n-1)d.$

$\frac{134}{7} + (n-1)\frac{91}{14} = 93$

$n - 1 = \left(93 - \frac{134}{7}\right) \cdot \frac{14}{91} = \frac{517}{7} \cdot \frac{14}{91} = \frac{1034}{91}$

$n = \frac{1034}{91} + 1 = \frac{1034+91}{91} = \frac{1125}{91}$

№11

$a_7 = 5$

$a_{19} = 21$

$a_n = 9$

$n - ?$

$$\begin{cases} 5 = a_1 + 6d \\ 21 = a_1 + 18d \end{cases} \Rightarrow 16 = 12d$$

$$d = \frac{7}{6}$$

$(a_1 = 9-)$

$a_n = a_1 + (n-1)d.$

$a_1 = a_n - (n-1)d$

$a_1 = 5 - 4d = 5 - 4 \cdot \frac{7}{6} = 5 - \frac{14}{3} =$

$= \frac{1}{3}$

$a_n = a_1 + (n-1)d$

$n = \frac{a_n - a_1}{d} + 1 = \left(9 - \frac{1}{3}\right) \cdot \frac{6}{7} + 1 =$

$=$?

№12

$a_6 + a_{10} = 18$

$a_8 - ?$

$$\begin{cases} a_6 = a_1 + 5d \\ a_{10} = a_1 + 9d \\ a_8 = a_1 + 7d \end{cases} \Rightarrow \begin{cases} 2a_1 + 14d = 18 \\ a_8 = a_1 + 7d \end{cases}$$

$$\Rightarrow \begin{cases} a_1 + 7d = 9 \\ a_8 = a_1 + 7d \end{cases} \Rightarrow \begin{cases} a_8 = 9 \end{cases}$$

Задача 13.

$a_3 = -7$

$a_2 + a_7 = -13$

$a_n < 0$

$a_n - ?$

$$\begin{cases} a_3 = a_1 + 2d \\ a_2 = a_1 + d \\ a_7 = a_1 + 6d \end{cases} \Rightarrow \begin{cases} 2a_1 + 2d = -7 \\ 2a_1 + 7d = -13 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} 3d = +1 \Rightarrow d = \frac{1}{3} \end{cases}$$

$$a_1 = a_3 - \frac{2}{3}$$

$$a_1 = -7 - \frac{2}{3} = \frac{-21-2}{3} = -\frac{23}{3}$$

$$\begin{cases} a_n = -\frac{23}{3} + (n-1) \cdot \frac{1}{3} \\ a_n < 0 \end{cases} \Rightarrow$$

$$a_n = -\frac{23}{3} + \frac{1}{3}n - \frac{1}{3} < 0$$

$$-\frac{23}{3} + \frac{1}{3}n - \frac{1}{3} < 0$$

$$\frac{-23 + n - 1}{3} < 0$$

$$\frac{-24 + n}{3} < 0$$

$$n < 24$$

$$n = 23$$

Ұяй: $a_{23} = -\frac{23}{3} + \frac{22}{3} = -\frac{1}{3}$

$a_1 = -6,5$

$a_2 = -6$

$a_n < 0$

$S'_n - ?$

2/ш/d 10

$d = a_2 - a_1 = -6 + 6,5 = +0,5$

$a_n = a_1 + (n-1)d < 0$

$\Rightarrow -6,5 + (n-1)0,5 < 0$

$(n-1)0,5 < 6,5$

$n - 1 < 13$

$n < 14$

$$S'_n = \frac{2a_1 + (n-1)d}{2} \cdot n \Rightarrow$$

$$S'_{13} = \frac{-13 + 6}{2} \cdot 13 = -9,5 \cdot 13 = -123,5$$

2/ш/d 12.

$a_m = n$

$a_n = m$

$S'_n - ?$

$$\begin{cases} a_m = a_1 + (m-1)d \\ a_n = a_1 + (n-1)d \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} m - n = (m-1)d - (n-1)d \Rightarrow \end{cases}$$

$\Rightarrow m - n = d(m+n)$

$d = \frac{m-n}{m+n}$

$a_1 = n - \left(\frac{n-m}{n+m}\right)(m-1)$

$a_n = a_1 + (n-1)d$

$a_1 = a_n - (n-1)d = m - (n-1)\left(\frac{n-m}{n+m}\right) =$

$= m - \frac{(n-1)(n-m)}{n+m}$

$S'_{min} = 2a_1 + (n-1)d.$

Задача 13

Е) $a_1 = 1$ $\quad d = 3$

$a_2 = 4$ $\quad S_n = \frac{a_1 + a_n}{2} \cdot n =$

$a_3 = 7$

$= \frac{1+x}{2} \cdot n = 117.$

$a_n = x$

$S'_n = 117$

$a_n - ?$

$x = \frac{117 \cdot 2}{n} - 1 =$

$= \frac{234}{r}$

$(n = \frac{117 \cdot 2}{1+x} = \frac{234}{1+x}$

$S_n = \frac{2a_1 + (n-1)d}{2}$

÷

№16 3ф. ғшд.

14. $a_{41} = 28$

$S'_{25} = 560$

$d - ?$

$$\begin{cases} S_{25} = \frac{2a_1 + (n-1)d}{2} \cdot n \\ a_{41} = a_1 + (n-1)d \end{cases} =$$

$$\Rightarrow \begin{cases} S'_{25} = \frac{2a_1 + 24d}{2} \cdot 25 \\ a_{41} = a_1 + 40d \end{cases}$$

$$\Rightarrow \begin{cases} 560 - 28 = 24\frac{(2a_1 + 24d)}{2} - a_1 \end{cases}$$

$$\begin{cases} a_{\cdot} \; a_1 + 40d = 28 \\ 25(a_1 + 12d) = 560 \end{cases} \Rightarrow \begin{cases} a_1 + 40d = 28 \\ 25a_1 \; a_1 + 12d = \frac{112}{5} \end{cases}$$

№10

$a_7 = 18$

$a_{10} - a_8 = 4$

$a_n < 45$

$S_n - ?$

$$\begin{cases} a_7 = a_1 + 6d = 18 \\ a_{10} = a_1 + 9d \\ a_8 = a_1 + 7d \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} a_7 = a_1 + 6d = 18 \\ 2d = 4 \\ d = 2 \end{cases} \Rightarrow \begin{cases} a_1 = 6. \end{cases}$$

$$a_n = a_1 + (n-1)d < 65$$

$$a_n = 6 + 2(n-2 < 65$$

$$2n + 4 < 65$$

$$n < -\frac{21}{2} = 20,5$$

$$n = 1, 2 \ldots 20$$

$$S'_{20} = 6 +$$

3z.

20. $7 \le 7n \le 130$ $\quad a_1 \ge 7$

$$n \le \frac{130}{7} \qquad n \in \left[7; \frac{130}{7}\right]$$

$$\left(S'_n = 7 + n\left(\frac{130}{7} - 1\right)d \left(7 + \frac{130}{7}\right)\frac{1}{2}\right)$$

$$\left(n \in \left[7; 18\frac{4}{7}\right]\right)$$

$$1 \le n \le \frac{130}{7}$$

$$n \in (1; 18)$$

$$n = 18.$$

$$S'_n = a_1 \cdot 2 \cdot \frac{7 + 17 \cdot 7}{2_1} \cdot 18^9 =$$

$$= 1197:$$

26. $\frac{100}{17} \overset{k\in n}{\leq} k \leq \frac{999}{17}$

$5\frac{15}{17} \leq k \leq 58\frac{13}{17}$

$n = 58 - 5 = 53$

$a_1 = 102$

$d = 17$

$a_n = 986$

$a_n = a_1 + (n-1)d$

$n = \frac{986 - 102}{17} + 1 =$

Інд. ш. Середня 3д 1-60; 3т. 1-31

19.11.05р.

1) $a_1 = 2,5$

$a_6 = 4$

$a_2 - ?$

$a_3 - ?$

$a_4 - ?$

$a_5 - ?$

$a_n = a_1 + (n-1)d$

$a_6 = 2,5 + 5d$

$d = \frac{4 - 2,5}{5} = 0,3$

$a_2 = 2,8$

$a_3 = 3,1$

$a_4 = 3,4$

$a_5 = 3,7$

Пар: 2,5; 2,8; 3,1; 3,4; 3,7; 4

2. $\overline{a_1 = 3}$

$a_{10} = 6$

$a_2; a_3; a_4;$

$a_5; a_6; a_7,$

$a_8; a_9 - ?$

$a_{10} = a_1 + (10-1)d$

$d = \frac{6-3}{9} = \frac{1}{3}$

$a_2 = \frac{1}{3} + 3 = 3\frac{1}{3}$

$a_3 = \frac{10}{3} + \frac{1}{3} = \frac{11}{3}$

$a_4 = \frac{12}{3}$; $a_5 = \frac{13}{3}$, $a_6 = \frac{14}{3}$, $a_7 = 5$

$a_8 = \frac{16}{3}$; $a_9 = \frac{17}{3}$

$\div$ 3; $\frac{1}{3}$; $\frac{10}{3}$; $\frac{11}{3}$; 4; $\frac{13}{3}$; $\frac{14}{3}$; 5; $\frac{16}{3}$; $\frac{17}{3}$; 6.

3. $a_1 = 5$

$a_9 = 1$

$a_2; a_3; a_4; a_5,$

$a_6; a_7; a_8; ?$

$a_9 = a_1 + 8d$

$d = \frac{1-5}{8} - \frac{1}{2} = -0,5$

$a_2 = 4,5$; $a_3 = 4$; $a_4 = 3,5$,

$a_5 = 3$; $a_6 = 2,5$; $a_7 = 2$,

$a_8 = 1,5$

$\div$ 5; 4,5; 4; 3,5; 3; 2,5; 2; 1,5; 1.

4) $a_1 = 6$

$a_7 = 4$

$a_2; a_3; a_4; a_5; a_6 - ?$

$a_7 = a_1 + 6d$

$d = \frac{4-6}{6} = -\frac{1}{3}$

$a_2 = \frac{17}{3}; a_3 = \frac{16}{3}; a_4 = 5,$

$a_5 = \frac{14}{3}; a_6 = \frac{13}{3}; a_7 =$

$\div 6; \frac{17}{3}; \frac{16}{3}; 5; \frac{14}{3}; \frac{13}{3}; 4.$

5. $a_{11} = 67$

$a_{25} = 158$

$a_n = 93$

$n - ?$

$$\begin{cases} a_1 + 10d = 67 \\ a_1 + 24d = 158 \\ a_1 + (n-1)d = 93 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} 14d = 91 \Rightarrow d = \frac{91}{14} \Rightarrow a_1 = 67 - 10 \cdot \frac{91}{14} = \\ a_1 + (n-1)d = 93 \end{cases}$$

$= \left(67 - \frac{455}{7} = \frac{154}{7} = 22\right) \quad a_1 = 2$

$$\Rightarrow \begin{cases} a_1 = 22; d = \frac{91}{14} = 6,5 \\ 22 + (n-1)\frac{91}{14}, 93 \end{cases} \Rightarrow n = (93-2) : 6,5 + 1 =$$

$= 91 : 6,5 + 1 = 15$

$n = (93 - 22) \cdot \frac{14}{91} + 1 = 71 : 6,5 + 1 = 12)$

6. $a_{30} = 3$

$a_{160} = 13$

$a_n = 5$

$n - ?$

$$\begin{cases} a_1 + 29d = 3 \\ a_1 + 159d = 13 \end{cases} \Rightarrow \begin{cases} 130d = 10 \\ d = 13\frac{1}{13} \end{cases}$$

$d = \frac{1}{13} \Rightarrow a_1 = \left(\frac{1}{3} - 29d = \frac{1}{13} - 377 = -374\right)$

$a_n = a_1 + (n-1)d = \frac{10}{13}$

$n = \left(\frac{a_n - a_1}{d} + 1 = \frac{5 + 374}{13} + 1 = 30{,}15\right) \Rightarrow$

$\Rightarrow n \in \varnothing$ $\quad n = N\left(5 - \frac{10}{13}\right) \cdot 13 + 1 = \frac{55}{13} \cdot 13 + 1 = 56$

Ответ: $n = 56$

7) $a_8 = -7$

$a_{103} = 31$

$a_n = 25$

$n - ?$

$$\begin{cases} a_1 + 7d = -7 \\ a_1 + 102d = 31 \end{cases} \Rightarrow 95d = 38$$

$d = 0{,}4$

$a_1 = -7 - 2{,}8 = -9{,}8$

$a_n = a_1 + (n-1)d$

$n = (25 + 9{,}8) : 0{,}4 + 1 = 87 + 1 = 88$

Ответ $n = 88$

8. $a_7 = 5$

$a_{19} = 21$

$a_n = 9$

$n - ?$

$$\begin{cases} a_1 + 6d = 5 \\ a_1 + 18d = 21 \end{cases} \Rightarrow 12d = 16 \Rightarrow a_1 = 5 - 8 = -3$$

$d = \frac{4}{3}$

$n = 12 \cdot \frac{3}{4} + 1 = 10$ Ответ: $n = 10$

9. $a_9 = 2$

$S_{11} = 15{,}4$

$a_3 - ?$

$$\begin{cases} a_1 + 8d = 2 \\ \frac{2a_1 + 10d}{2} \cdot 11 = 15{,}4 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} a_1 + 8d = 2 \\ 22a_1 + 110d = 30{,}8 \end{cases} \Big| \cdot (-22)$$

$$\Rightarrow \begin{cases} 102d = 28{,}8 \\ \cancel{-176d = -32{,}8} \\ d = \frac{72}{255} \end{cases}$$

$$a_1 = 2 - 8 \cdot \frac{72}{255} = 2 - \frac{576}{255} = -\frac{66}{255}$$

$$a_3 = -\frac{66}{255} + \frac{144}{255} = \frac{78}{255}$$

10. $a_7 = 2$

$S_{10} = 17$

$a_5 - ?$

$$\begin{cases} a_1 + 6d = 2 \\ \frac{2a_1 + 9d}{2} \cdot 10 = 17 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} a_1 + 6d = 2 \\ 20a_1 + 90d = 34 \end{cases} \Rightarrow \begin{cases} 20a_1 + 120d = 40 \\ 20a_1 + 90d = 34 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} 30d = 6 \\ d = \frac{1}{5} = 0{,}2 \end{cases} \Rightarrow a_1 = 0{,}8$$

$$a_5 = 0{,}8 + 4 \cdot 0{,}2 = 1{,}6$$

Ответ: $a_5 = 1{,}6$

11. $a_6 = 8$

$S_{30} = 468$

$d - ?$

$$\begin{cases} a_1 + 5d = 8 \\ \frac{2a_1 + 29d}{2} \cdot 30 = 468 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} a_1 + 5d = 8 \\ 60a_1 + 870d = 936 \end{cases} \Rightarrow 570d = 456$$

$$d = 0{,}8$$

12. $a_9 = 26$

$S_{13} = 260$

$d = ?$

$$\begin{cases} a_1 + 8d = 26 \\ \frac{2a_1 + 12d}{2} \cdot 13 = 260 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} 26a_1 + 208d = 676 \\ 26a_1 + 156d = 520 \end{cases} \Rightarrow 52d = 156$$

$$d = 3$$

13. $a_7 = 33$

$S_{12} = 366$

$d - ?$

$$\begin{cases} a_1 + 6d = 33 \\ \frac{2a_1 + 11d}{2} \cdot 12 = 366 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} 24a_1 + 144d = 792 \\ 24a_1 + 132d = 732 \end{cases} \Rightarrow 12d = 60$$

$$d = 5$$

14. $a_{41} = 28$

$S_{25} = 560$

$d - ?$

$$\begin{cases} a_1 + 40d = 28 \\ \dfrac{2a_1 + 24d}{2} \cdot 25 = 560 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} 50a_1 + 2000d = 1400 \\ 50a_1 + 600d = 1120 \end{cases} \Rightarrow 1400d = 280$$

$$d = 0{,}2$$

15. $a_{23} = -26$

$S_{25} = 100$

$d - ?$

$$\begin{cases} a_1 + 22d = -26 \\ \dfrac{2a_1 + 24d}{2} \cdot 25 = 100 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} 50a_1 + 1100d = -1300 \\ 50a_1 + 600d = 200 \end{cases} \Rightarrow 500d = -1500$$

$$d = -3$$

16. $a_{16} = 16$

$S_{25} = 340$

$d - ?$

$$\begin{cases} a_1 + 15d = 16 \\ \dfrac{2a_1 + 24d}{2} \cdot 25d = 340 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} 50a_1 + 750d = 800 \\ 50a_1 + 600d = 680 \end{cases} \Rightarrow \begin{cases} 150d = 120 \\ d = 0{,}8 \end{cases}$$

17. $a_5 = 22$

$a_1 - a_3 = 24$

S'_7 - ?

$$\begin{cases} a_7 = a_1 + 6d \\ a_3 = a_1 + 2d \end{cases} \Rightarrow \begin{cases} 4d = 24 \\ d = 6 \end{cases}$$

$a_1 = 22 - 4 \cdot 6 = -2$

$(a_7 = -2 + 36 = 34)$

$S'_7 = \frac{-4 + 36}{2} \cdot 7 = 112$

18. $a_{11} = 34$

$a_1 - a_4 = 12$

S'_8 - ?

$$\begin{cases} a_1 = a_1 + 6d \\ a_4 = a_1 + 3d \end{cases} \Rightarrow 3d = 12$$

$d = 4$

$a_1 = 34 - 40 = -6$

$S'_8 = \frac{-12 + 28}{2} \cdot 8 = 64$

19. $a_6 + a_{10} = 18$

a_8 - ?

$$\begin{cases} a_1 + 5d = a_6 \\ a_1 + 9d = a_{10} \end{cases} \Rightarrow 2a_1 + 14d = 18$$

$a_1 + 7d = 9$

$a_8 = a_1 + 7d \Rightarrow a_8 = 9$

Ответ: $a_8 = 9$

20. $a_4 + a_6 = 12$

a_5 - ?

$$\begin{cases} a_1 + 3d = a_4 \\ a_1 + 5d = a_6 \end{cases} \Rightarrow 2a_1 + 8d = 12$$

$a_1 + 4d = 6$

$a_5 = a_1 + 4d = 6$

Ответ: $a_5 = 6$.

21. $a_{13} + a_8 = 14$

$S_{20} - ?$

$$\begin{cases} a_1 + 12d = a_{13} \\ a_1 + 7d = a_8 \end{cases} \Rightarrow \begin{cases} 2a_1 + 19d = 14 \end{cases}$$

$$S_{20} = \frac{2a_1 + 19d}{2} \cdot 20 = \frac{14}{2} \cdot 20 = 140$$

22. $S_{11} = 22$

$a_6 - ?$

$$\frac{2a_1 + 10d}{2} \cdot 11 = 22$$

$$a_1 + 5d = 2$$

$$a_6 = a_1 + 5d = 2$$

23. $a_3 + a_5 + a_7 = 6$

$S_9 - ?$

$$\begin{cases} a_1 + 2d = a_3 \\ a_1 + 4d = a_5 \\ a_1 + 6d = a_7 \end{cases} \Rightarrow \begin{matrix} 3a_1 + 12d = 6 \\ 2a_1 + 8d = 9 \end{matrix}$$

$$S_9 = \frac{2a_1 + 8d}{2} \cdot 9 = \frac{9 \cdot 9}{2} = 40,5$$

24. $S_5 + 3a_{11} = 8$

$a_6 - ?$

$$\begin{cases} S_5 = \frac{2a_1 + 4d}{2} \cdot 5 = (a_1 + 2d)5 \\ 3a_{11} = 3a_1 + 30d \end{cases}$$

$$\Rightarrow \begin{cases} 5a_1 + 10d = S_5 \\ 3a_1 + 30d = 3a_{11} \end{cases} \Rightarrow \begin{matrix} 8a_1 + 40d = 8 \\ a_1 + 5d = 1 \end{matrix}$$

$a_6 = a_1 + 5d = 1$

25. $11a_3 + 3a_{17} = 42$

$a_6 - ?$

$$\begin{cases} 11a_1 + 22d = 11a_3 \\ 3a_1 + 48d = 3a_{17} \end{cases} \Rightarrow$$

$\Rightarrow 14a_1 + 70d = 42$

$a_1 + 5d = 3$

$a_6 = a_1 + 5d = 3$

Ответ: $a_6 = 3$

26. $a_6 = -26$

$S_5 = -40$

$S_8 - ?$

$$\begin{cases} a_1 + 5d = -26 \\ 5a_1 + 10d = -40 \end{cases} \Rightarrow \begin{cases} 5a_1 + 25d = -130 \\ 5a_1 + 10d = -40 \end{cases} \Rightarrow$$

$\Rightarrow 15d = -90$

$d = -6 \quad \Rightarrow a_1 = -26 + 30 = 4$

$$S_8 = \frac{8 \cdot 42}{2} \cdot 8 = -136$$

27. $a_7 = 16$

$S_{10} = 130$

$S_6 - ?$

$$\begin{cases} a_1 + 6d = 16 \\ \frac{2a_1 + 9d}{2} \cdot 10 = 130 \end{cases} \Rightarrow \begin{cases} 2a_1 + 12d = 32 \\ 2a_1 + 9d = 26 \end{cases} \Rightarrow$$

$\Rightarrow 3d = 6 \Rightarrow d = 2 \quad a_1 = 16 - 12 = 4$

$$S_6 = \frac{8 + 10}{2} \cdot 6 = 6 \cdot 54$$

Ответ: $S_6 = 54$

28. $a_{10} = 33$

$S_7 = 105$

$S_4 - ?$

$$\begin{cases} a_1 + 9d = 33 \\ a_1 + 21d = \\ a_1 + 3d = 15 \end{cases} \Rightarrow 6d = 18 \quad d = 3$$

$a_1 = 6$

$$S_4 = \frac{12 + 3d}{2} \cdot 4 = 42$$

Ответ: $S_4 = 42$

29. $a_6 = 27$

$S_7 = 105$

$S_9 - ?$

$$\begin{cases} a_1 + 5d = 27 \\ a_1 + 3d = 15 \end{cases} \Rightarrow 2d = 12 \quad d = 6$$

$a_1 = -3$

$$S_9 = \frac{-6 + 48}{2} \cdot 9 = 189$$

30. $a_9 = 29$

$S_6 = 75$

$S_{10} - ?$

$$\begin{cases} a_1 + 8d = 29 \\ 2a_1 + 5d = 25 \end{cases} \Rightarrow 11d = 33 \quad d = 3 \quad a_1 = 5$$

$$S_{10} = \frac{10 + 27}{2} \cdot 10 = 185$$

31. $a_{12} = 51$

$S_7 = 77$

$S_{12} - ?$

$$\begin{cases} a_1 + 11d = 51 \\ a_1 + 3d = 11 \end{cases} \Rightarrow \begin{cases} 8d = 40 \\ d = 5 \end{cases}; a_1 = -4$$

$S_{12} = (-8 + 55)\ 6 = 282$

32. $a_3 + a_{11} = 13$

$a_5 + a_9 - ?$

$$\begin{cases} a_1 + 2d = a_3 \\ a_1 + 10d = a_{11} \end{cases} \Rightarrow 2a_1 + 12d = 13$$

$$\begin{cases} a_1 + a_4 = a_5 \\ a_1 + a_8 = a_9 \end{cases} \Rightarrow \begin{cases} 2a_1 + 12d = 13 \end{cases}$$

Ответ: $a_5 + a_9 = 13$

33. $a_4 + a_8 = 52$

$S_5 = 40$

$d - ?$

$$\begin{cases} a_1 + 3d = a_4 \\ a_1 + 7d = a_8 \end{cases} \Rightarrow a_1 + 5d = 26$$

$$S_5 = \frac{a_1 + 2d}{2} \cdot 5 = 8$$

$$\begin{cases} a_1 + 5d = 26 \\ a_1 + 2d = 8 \end{cases} \Rightarrow \begin{cases} 3d = 18 \\ d = 6 \end{cases}$$

Ответ: $d = 6$

34. $a_9 = 28$

$a_7 - a_4 = 12$

$S_6 - ?$

$$\begin{cases} a_1 + 8d = 28 \\ a_1 + 6d = a_7 \\ a_1 + 3d = a_4 \\ a_7 - a_4 = 12 \end{cases} \Rightarrow \begin{cases} a_1 + 8d = 28 \\ 3d = 12 \\ d = 4 \end{cases} \Rightarrow$$

$\Rightarrow a_1 = -4$

$$S_6 = \frac{-8 + 20}{2} \cdot 6 = 36$$

Ответ: $S_6 = 36$

35. $a_7 = -16$

$S_{10} = -130$

$$\begin{cases} a_1 + 6d = -16 \\ 2a_1 + 9d = -26 \end{cases} \Rightarrow \begin{matrix} 3d = -6 \\ d = -2 \end{matrix}$$

S_{13} - ?

$a_1 = -4$

$S_{13} = (a_1 + 6d)13 =$

$= (-4 - 12) \cdot 13 = -208$

Ответ: $S_{13} = -208$

36. $a_5 + a_9 = 36$

$S_5 = -50$

$S_{10} = ?$

$$\begin{cases} a_1 + 4d = a_5 \\ a_1 + 8d = a_9 \end{cases} \Rightarrow a_1 + 6d = 18$$

$$\begin{cases} a_1 + 2d = -50 \\ a_1 + 6d = 18 \end{cases} \Rightarrow 4d = 28$$

$d = 5,75$

$(S_{10} = (-48 + 63) \cdot 5 = 75)$

$a_1 = -16,5$

$\Rightarrow S_{10} = -16,5 + 51,75 = 35,25$

38. $a_{11} = 1,12$

$S_{20} = 21,3$

a_4 - ?

$$\begin{cases} a_1 + 10d = 1,12 \\ (2a_1 + 19d) \cdot 10 = 21,3 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} 2a_1 + 20d = 2,24 \\ 2a_1 + 19d = 2,13 \end{cases} \Rightarrow d = 0,11 \Rightarrow a_1 = 0,02$$

$a_4 = 0,02 + 0,33 = 0,35$

38.

39.

40

38. $a_5 + a_{11} = 38$

$S_5 = 45$

$S_9 - ?$

$$\begin{cases} a_1 + 4d = a_5 \\ a_1 + 10d = a_{11} \end{cases} \Rightarrow a_1 + 7d = 19$$

$$\begin{cases} a_1 + 7d = 19 \\ a_1 + 2d = 9 \end{cases} \Rightarrow 5d = 10 \quad a_1 = 5$$

$d = 2$

$S_9 = (5+8)\cdot 9 = 117$ Ответ: $S_9 = 117$

39. $a_8 + a_{14} = -68$

$S_8 = -64$

$d - ?$

$$\begin{cases} a_1 + 7d = a_8 \\ a_1 + 13d = a_{14} \\ a_8 + a_{14} = -68 \\ 2a_1 + 7d = -16 \end{cases} \Rightarrow$$

$$\begin{cases} 2a_1 + 20d = -68 \\ 2a_1 + 7d = -16 \end{cases} \Rightarrow \begin{cases} 13d = -52 \\ d = 4 \quad (a_1 = -22) \end{cases}$$

$S_8 = (-24 + 28)\cdot 4 = 8$

40. $a_{11} = -45$

$S_9 = -135$

$S_{12} - ?$

$$\begin{cases} a_1 + 10d = -45 \\ a_1 + 8d = -15 \end{cases} \Rightarrow \begin{cases} d = -15 \\ a_1 = 105 \end{cases}$$

$S_{12} = 6\cdot(210 + 165) = 270$

41. $a_{21} = 36$

$a_3 + a_9 = 9$

$a_{11} - ?$

$$\begin{cases} a_1 + 2d = a_3 \\ a_1 + 8d = a_9 \\ a_3 + a_9 = 9 \\ a_1 + 20d = 36 \end{cases} \Rightarrow \begin{cases} 2a_1 + 10d = 9 \\ 2a_1 + 40d = 72 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} 30d = 63 \\ d = 2,1 \end{cases} \qquad a_1 = -6$$

$a_{11} = -6 + 21 = 15$

42. $a_6 = 8$

$a_{15} + a_7 = 24$

$a_{20} = ?$

$$\begin{cases} a_1 + 5d = 8 \\ a_1 + 14d = a_{15} \\ a_1 + 6d = a_7 \\ a_{15} + a_7 = 24 \end{cases} \Rightarrow \begin{cases} a_1 + 5d = 8 \\ a_1 + 10d = 12 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} 5d = 4 \\ d = 0,8 \end{cases} \qquad a_1 = 4$$

$a_{20} = 4 + 15,2 = 19,2$

43. $a_7 - a_3 = 0,8$

$S_{10} = 17$

$a_7 = ?$

$$\begin{cases} a_7 - a_3 = 0,8 \\ a_1 + 6d = a_7 \\ a_1 + 2d = a_3 \\ 2a_1 + 9d = 3,4 \end{cases} \Rightarrow \begin{cases} 4d = 0,8 \\ a_1 = \frac{3,4 - 9d}{2} \end{cases} \Rightarrow$$

$\Rightarrow \begin{cases} d = 0,2 \\ a_1 = 0,8 \end{cases} \Rightarrow a_7 = 0,8 + 1,2 = 2$

Ответ: $a_7 = 2$

44. $a_7 = 33$

$a_8 + a_5 = 61$

$a_{90} - ?$

$$\begin{cases} a_1 + 6d = 33 \\ a_1 + 7d = a_8 \\ a_1 + 4d = a_5 \\ a_8 + a_5 = 61 \\ a_1 + 80d = a_{90} \end{cases} \Rightarrow \begin{cases} a_1 + 6d = 33 \\ 2a_1 + 11d = 61 \\ a_1 + 8d = a_9 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} 2a_1 + 12d = 66 \\ 2a_1 + 11d = 61 \\ a_1 + 8d = a_{90} \end{cases} \Rightarrow \begin{cases} d = 5 \\ a_1 = 3 \\ a_{90} = 48 \end{cases}$$

Ответ: $a_{10} = 48$

45. $a_9 = 2,6$

$S'_{13} = 26$

$a_{10} - ?$

$$\begin{cases} a_1 + 8d = 2,6 \\ a_1 + 6d = 2 \end{cases} \Rightarrow \begin{cases} d = 0,3 \\ a_1 = 0,2 \end{cases} \Rightarrow$$

$\Rightarrow a_{10} = 0,2 + 2,7 = 2,9$

Ответ: $a_{10} = 2,9$

46. $a_9 = 0,2$

$S'_{11} = 1,54$

$a_8 - ?$

$$\begin{cases} a_1 + 8d = 0,2 \\ a_1 + 5d = 0,14 \end{cases} \Rightarrow \begin{cases} d = 0,02 \\ a_1 = 0,04 \end{cases} \Rightarrow$$

$\Rightarrow a_8 = 0,04 + 0,14 = 0,18$

47. $a_7 = -18$

$a_{12} - a_{10} = -4$

S_5 - ?

$$\begin{cases} a_1 + 6d = -18 \\ a_1 + 11d = a_{12} \\ a_1 + 9d = a_{10} \\ a_{12} - a_{10} = -4 \end{cases} \Rightarrow \begin{cases} a_1 = 6 \\ d = -2 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} S_5 = 5(6-4) = 10 \end{cases}$$

Ответ: S_5 - ?

20.11 05 1. $a_1 = 2$

$a_2 = 10$

a_6 - ?

$$d = \frac{a_2}{a_1} = 5$$

$$a_6 = a_1 q^5 = 2 \cdot 5^5 = 6250$$

2. $a_1; a_2 \dots a_n \dots$

a_n

$$a_n = \left(\frac{a_2}{a_1}\right)^{n-1} \cdot a_1$$

3. $a_2 = a_1 q$

$a_3 = a_2 q = a_1 q^2$

$a_4 = a_3 q = a_1 q^3$

$a_n = a_{n-1} q = a_1 q^{n-1}$

4. $a_1 = 2$

$a_2 = 4$

$a_{50} - ?$

$q = 2$

$a_{50} = a_1 q^{49} = 2 \cdot 2^{49} = 2^{50}$

5. $a_6 = 96$

$a_9 = 786$

$a_2 - ?$

$$\begin{cases} a_6 = a_1 q^5 = 96 \\ a_9 = a_1 q^8 = 786 \end{cases} \Rightarrow q^3 = \frac{393}{48}$$

$a_2 = \quad a_1 =$

6. $a_1 = 6$

$a_5 = 162$

$a_2; a_3; a_4$

$$a_1 q \begin{cases} a_1 q^4 = 162 \\ a_1 = 6 \end{cases} \Rightarrow \begin{cases} q^4 = 27 \end{cases}$$

$a_2 = a_1 q = 6 \cdot \sqrt[4]{27}$

$a_3 = a_1 q^2 = 6 \cdot \sqrt{27}$

$a_4 = a_1 q^3 = 6 \cdot \sqrt[4]{27^3}$

7. $a_2 = 6; \; a_6 = 96$

$q - ?$

$$\begin{cases} a_1 q = 6 \\ a_1 q^5 = 96 \end{cases} \Rightarrow q^4 = 16 \Rightarrow q = 2$$

$a_3 = -2$

$a_4 = -3$

$a_1 - ?$

$q - ?$

$$\begin{cases} a_1 q^2 = -2 \\ a_1 q^3 = -3 \end{cases} \Rightarrow q = 1{,}5$$

$a_1 q^2 = -2$

$a_1 = \frac{-2}{2{,}25} = -0{,}8$

Ответ: $q = 1{,}5; \; a_1 = -0{,}8$

$b_1 = 16$

$q = \frac{3}{2}$

$b_3 - ?$

$b_5 - ?$

$$\begin{cases} b_1 q^6 = 16 \\ q = \frac{3}{2} \end{cases} \Rightarrow \begin{cases} b_1 = \frac{16 \cdot 64}{729} = \frac{1024}{729} \\ q = \frac{3}{2} \end{cases}$$

$$b_3 = b_1 q^2 = \frac{1024}{729} \cdot \frac{9}{4} = \frac{256}{81}$$

$$b_5 = b_1 q^4 = \frac{1024}{729} \cdot \frac{81}{16} = \frac{64}{9}$$

$b_1 = 18$

$b_2 + b_9 = 68$

$q - ?$

$$\begin{cases} b_1 q^6 = b_7 \\ b_1 q^8 = b_9 \end{cases} \Rightarrow \begin{cases} b_1 q^6 + b_1 q^8 = 68 \\ b_1 (q^6 + q^8) = 68 \end{cases}$$

$b_1 = 9,6$

$b_2 = 4,8$

$n > 1$

$n - ?$

$$\begin{cases} b_1 q = 4,8 \\ b_1 = 9,6 \end{cases} \Rightarrow q = 0,5$$

$$b_1 q^{n-1} > 1$$

$$9,6 \cdot 0,5^{n-1} > 1$$

$$9,6 \cdot 0,5^n > 0,5$$

$$\frac{9,6 \cdot 0,5^n}{0,5} > 1 \qquad 9,6 \cdot 0,5^n > 0,5$$

$0{,}5^n = \frac{0{,}5}{9{,}6}$

8. $a_6 = 96$

$a_9 = 769$

$a_1 - ?$

$q - ?$

$$\begin{cases} a_1 q^5 = 96 \\ a_1 q^8 = 769 \end{cases} \Rightarrow q^3 = \frac{769}{96}$$

$$a_1 = \frac{96}{q^5} = \frac{96^{\frac{5}{3}}}{96^{\frac{5}{3}}} 769^{\frac{5}{3}}$$

$a_4 = 16$

$a_7 = 128$

$q - ?$

$a_2 - ?$

$$\begin{cases} a_1 q^3 = 16 \\ a_1 q^6 = 128 \end{cases} \Rightarrow q^3 = 8$$

$q = 2$

$a_1 = \frac{16}{8} = 2$

$a_2 = a_1 q = 4$

Ответ: $a_2 = 4$; $q = 2$

$a_2 = 243$

$a_3 = 9$

$a_7 - ?$

$a_{10} - ?$

$$\begin{cases} a_1 q = 243 \\ a_1 q^2 = 9 \end{cases} \Rightarrow q = \frac{1}{27}$$

$a_1 = 243 \cdot 27 = 6561$

$a_7 = 6561 \cdot \frac{1}{27^6} = \frac{6561}{387420489} = 0{,}000017$

$a_{10} = \frac{6561}{27^9} = \frac{6561}{7625597412} = 0{,}00000086$

$a_6 - ?$

$a_4 = 2$

$a_5 = 162$

$q - ?$

$a_6 - ?$

$\begin{cases} a_1 q^4 = a_5 \\ a_1 q^7 = 162 \end{cases}$ $\Rightarrow q = 3$

$a_6 = a_1 q^5 = 2 \cdot 3^5 = 486$

Ответ: $a_6 = 486$

$a_6 - a_2 = 10$

$a_4 - a_2 = 2$

$q - ?$

$a_{10} - ?$

$\begin{cases} a_1 q^5 = a_6 \\ a_1 q = a_2 \end{cases}$ $\Rightarrow a_1 q^5 - a_1 q = 10$

$\begin{cases} a_1 q^3 = a_4 \\ a_1 q = a_2 \end{cases}$ $\Rightarrow a_1 q^3 - a_1 q = 2$

$\begin{cases} a_1 q^5 - a_1 q = 10 \\ a_1 q^3 - a_1 q = 2 \end{cases}$ $\Rightarrow a_1 q^5 - a_1 q^3 = 8$

$a_2 = 6$

$a_4 = 54$

$?\ q < 0$

$a_3 - ?$

$a_6 - ?$

$\begin{cases} a_1 q = 6 \\ a_1 q^3 = 54 \end{cases}$ $\Rightarrow q = 3$

$a_1 = 2$

$a_3 = a_1 q^2 = 2 \cdot 9 = 18$

$a_6 = a_1 q^5 = 2 \cdot 3^5 = 486$

Ответ: 18

$a_3 = 18$

Ответ: $a_6 = 486$

$q = 3$

$a_6 - ?$

Ответ: $a_6 = 486$

$$\frac{a_1 q\,(q^4-1)}{a_1 q\,(q^2-1)} = 5$$

$$\frac{q^4}{q^2} = 5$$

$$q^2 = \sqrt{5}$$

$a_{10} = a_1(\sqrt{5}^7 - \sqrt{5}) = 2$

$a_1 = \frac{1}{\sqrt{5}}$

$a_{10} = a_1 q^9 =$

$= \frac{1}{\sqrt{5}} \cdot (\sqrt{5})^{18} = 625$

Ответ: $a_{10} = 625$

$a_5 - a_1 = 9$

$a_1 + a_3 = 3$

q - ?

a_1 - ?

a_7 - ?

$\begin{pmatrix} a_1 q^4 = a_5 \\ a_1 \end{pmatrix}$ $a_1 q^4 - a_1 = 9$

$a_1(q^4 - 1) = 9$

$a_1 + a_1 q^2 = 3 \Rightarrow a_1(q^2+1) = 3$

$\frac{q^4-1}{q^2+1} = 3$

$\frac{(q^2-1)(q^2+1)}{q^2+1} = 3$

$q^2 = 4 \quad q = 2 \Rightarrow$

$\begin{pmatrix} a_1 = a_1 q^4 - 9 \end{pmatrix}$

$a_1 + a_1 q^2 = 3$

$a_1 = \frac{3}{1+q^2} = \frac{3}{5} = 0,6$

$a_7 = a_1 q^6 = 0,6 \cdot 64 = 38,4$ Ответ: $q = 2; a_1 = 0,6; a_7 = 38,4$

$a_2 - a_7 = 36$

$a_3 = 12$

$q - ?$

$a_4 - ?$

$a_5 - ?$

$$\begin{cases} a_1 q - a_1 q^6 = 36 \\ a_1 q^2 = 12 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} \dfrac{1 - a_1 q^5}{a_1 q} = 3 \\ a_1 = \dfrac{12}{q^2} \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} \dfrac{1 - \frac{12}{q^2} \cdot q^5}{a_1 \cdot \frac{12}{q^2} \cdot q} = 3 \end{cases} \Rightarrow \frac{(1 - 12q^3)q}{12} = 3$$

$$q - 12q^4 = 36$$

$$12q^4 - q + 36 = 0$$

$$\begin{cases} a_1 q - a_1 q^6 = 36 \\ a_1 = \dfrac{12}{q^2} \end{cases} \Rightarrow \frac{12}{q^2} q - \frac{12}{q^2} q^6 = 36$$

$$\frac{12}{q} - 12q^4 = 36$$

? $12 - 12q^5 - 36q = 0$

9. $a_1 = 12$

$a_2 = 48$

$a_8 - ?$

$a_n - ?$

$d = \frac{a_2}{a_1} = 4$

$a_8 = a_1 q^7 = 12 \cdot 4^7 = 150528$

$a_n = 12 \cdot 4^{n-1}$

$a_1 = 48$

$a_2 = 12$

$a_8 - ?$

$d = \frac{1}{4}$

$a_8 = 48 \cdot \frac{1}{4^7} = 48 \cdot \frac{1}{16224} = 0,002$

$a_1 = 0,1$

$a_2 = 0,01$

$a_8 - ?$

$d = 0,1$

$a_8 = 0,1 \cdot 0,1^7 = 0,1^8$

Ответ: $a_8 = 0,1^8$.

10. $a_1 = 6$

$a_3 = 24$

$a_2 - ?$

$\begin{cases} a_1 q^2 = 24 \\ a_1 = 6 \end{cases} \Rightarrow q^8 = 2$

$a_2 = a_1 q = 12$

Ответ: $q = 2$

$a_2 = 12$.

11. $a_1 = 2$

$a_5 = 32$

$a_2; a_3; a_4 - ?$

$a_1 q^4 = 32$

$q = 2$

$a_2 = 4$; $a_3 = 8$; $a_4 = 16$

? 12. $a_{11} = 2$

$a_{14} = 54$

$a_n = 18$

$n - ?$

$$\begin{cases} a_1 q^{10} = 2 \\ a_1 q^{13} = 54 \end{cases} \Rightarrow q^3 = 27$$

$$q = 3$$

$$a_1 = \frac{2}{1594323}$$

$$a_n = a_1 q^{n-1} = 18$$

13. Пусть начальный член $= b$

15. ?

$$S_n = \frac{a_n q - a_1}{q - 1}$$

7. $a_1 = 3$

$a_2 = -6$

$n = 8$

$S_n - ?$

$$a_2 = a_1 q = b \Rightarrow q = 2$$

$$S_6 = \frac{3(2^6 - 1)}{-2 - 1} = -63$$

? 8) $S_5 = 31$

$a_1 + a_5 = 17$

$a_n = 128$

$a_1 - ?$

$q - ?$

$n - ?$

$$\begin{cases} S_5 = \frac{a_1(q^5 - 1)}{q - 1} = 31 \\ a_1 q^4 + a_1 = 17 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} \frac{(q^5 - 1)(q^4 - 1)}{(q - 1)(q^4 + 1)} = \frac{17}{31} \end{cases}$$

9) $a_2 = 384$

$a_6 = 48$

---

a_9 - ?

q - ?

S_9 - ?

$$\begin{cases} a_1 q = 384 \\ a_1 q^5 = 48 \end{cases} \Rightarrow q^4 = 0{,}125 = 0{,}5\sqrt{0{,}5}$$

a_{10} ? $a_1 = \dfrac{384}{0{,}5\sqrt{0{,}5}} = \dfrac{768}{\sqrt{0{,}5}} = \dfrac{768\sqrt{0{,}5}}{0{,}5} =$

$= 1536\sqrt{0{,}5}$

$a_9 a = 1536\sqrt{0{,}5} \cdot \sqrt[4]{0{,}5^8} =$

$= 0{,}25$

$$S_9 = \frac{1536\sqrt{0{,}5}\,((0{,}5\sqrt{0{,}5})^9 - 1)}{0{,}5\sqrt{0{,}5} - 1}$$

10. $a_1 + a_4 = -49$

$a_2 + a_3 = 14$

$$\begin{cases} a_1 + a_1 q^3 = -49 \\ a_1 + a_1 q + a_1 q^2 = 14 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} \frac{1}{q} + q = -3{,}5 \Rightarrow q^2 + 3{,}5q + 1 = 0 \end{cases}$$

59246. 12. $\div a_1 = 3$

$a_2 - 6$

$a_2 - ?$

$a_3 - ?$

$\div 3; 3+d; 3+2d$

$3+d =$

$\div 3; d-3; 3+2d$

$d - ?$

$(d-3)^2 = 9+6d$

$d^2 + 9 - 6d = 9+6d.$

$d^2 - 12d = 0$

$d(d-12) = 0$

$d = 12$

$\div 3; 3; 3$ (

$\div$

$\div a_1; a_1+d; a_1+2d; a_1+3d$

$\div a_1-2; a_1-7; a_1-9; a_1-5$

$$\begin{cases} a_1 - 7 = \sqrt{(a_1-2)(a_1-9)} \\ a_1 - 9 = \sqrt{(a_1-7)(a_1-5)} \end{cases}$$

$\div$ $a_1 - 2 ; a_1 + d - 7 ; a_1 + 2d - 9 ; a_1 + 3d - 9$

$$\begin{cases} a_1 + d - 7 = \sqrt{(a_1 - 2)(a_1 + 2d - 9)} \\ a_1 + 2d - 9 = \sqrt{(a_1 + d - 7)(a_1 + 3d - 9)} \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} a_1 + d - 7 = \sqrt{a_1^2 + 2da_1 - 9a_1 - 2a_1} \end{cases}$$ лишн

$x ; y ; z ; t$

14. $\div$ $x ; y ; z$

$\div$ $y ; z ; t$

$$\begin{cases} x + t = 64 \\ y + x = 48 \\ y^2 = xz \\ 2z = y + t \end{cases} \Rightarrow \begin{cases} y^2 = yz \\ 2z = y + t \\ t = 64 - x \\ z = 48 - y \end{cases} \Rightarrow \begin{cases} y^2 = 48y - y^2 \\ y + 64 - x = 96 - 24 \end{cases}$$

$$\begin{cases} x = 3y - 32 \\ y^2 = (3y - 32)(48 - y) \end{cases}$$

15. $\div b_1 ; b_1 q ; b_1 q^2$

$\div b_1 ; b_1 q ; b_1 q^2 - 4$

$$\begin{cases} b_1 + b_1 q + b_1 q^2 = 28 \\ b_1 + b_1 q + 2 b_1 q = b_1 + b_1 q^2 - 4 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} b_1 (1 + q + q^2) = 28 \\ b_1 (-2q + q^2 + 1) = 4 \end{cases} \Rightarrow \begin{cases} b_1 (1-q)^2 = 4 \\ \frac{1 + q + q^2}{1 - 2q + q^2} \end{cases} \Rightarrow$$

$$\Rightarrow 6q^2 = 1$$

$$6q^2 - 15q + 6 = 0$$

$$2q^2 - 5q + 2 = 0$$

16. $\div a_1 ; a_1 + d ; a_1 + 2d$

$\div a_1 ; a_1 + d ; a_1 + 2d + 2$

$$a_1 + a_1 + d + a_1 + 2d = 12$$

$$\begin{cases} 3a_1 + 3d = 12 \\ (a_1 + d)^2 = a_1 (a_1 + 2d + 2) \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} a_1 + d = 4 \\ a_1^2 + d^2 + 2a_1 d = a_1^2 + 2a_1 d + 2a_1 \end{cases}$$

$$\Rightarrow \begin{cases} a_1 + d = 4 \\ 2a_1 + d^2 = 0 \end{cases} \Rightarrow \begin{cases} a_1 = 4 - d \\ 8 - 2d + d^2 = 0 \end{cases}$$

$$d^2 - 2d + 8 = 0$$

$$D = 4$$

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3q. ариф.

15. $a_1 = -6,5$

$a_2 = -6$

a_n

(32) 46. $b_5 = 54$

$b_8 = 1458$

$b_n < 4374$

$n - ?$

$$\begin{cases} a_1 q^4 = 54 \\ b_1 q^7 = 1458 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} q^3 = 27 \\ q = 3 \end{cases}$$

$$b_1 = \frac{54}{129} = \frac{6}{81} = \frac{2}{27}$$

$$b_n = b_1 q^{n-1} < 0$$

$$\frac{2}{27} \cdot 3^{n-1} < 0$$

$n = 10$

$10w$

$y_9 - x, y, z$.

$- y, x, z$

$y^2 = xz$

$q - ? \quad q = \frac{y}{x}$

$\frac{y}{z} = \frac{z}{x}$

$\begin{cases} y^2 = xz \\ x = 8z + y \end{cases} \Rightarrow \begin{cases} z = \frac{y^2}{x} \\ \frac{y}{z} = \frac{z}{x} \end{cases}$ $z = 2x$

$y_8 \cdot b_4 = 10$

$b_1 = 80$

$Q_n < 76812800$

$n - ?$

$\begin{cases} b_4 = b_1 q^3 = 10 \\ b_7 = b_1 q^6 = 80 \end{cases} \Rightarrow$

$q^3 = 8$

$\Rightarrow q = 2$

$b_1 = \frac{b_4}{q^3} = \frac{10}{8} = \frac{5}{4}$

$(b_n = b_1 \cdot q^{n-1})$

$\frac{5}{4} \cdot 2^{n-3} < 12800$

$2^8 \cdot 2^{n-3} < 2^8$

$n - 3 < 8$

$n < 9!$

$n = 10$

$$y^2 = 2x^2 - xy$$

$$\left(\frac{y}{x}\right)^2 + \frac{y}{x} - 2 = 0$$

$$\frac{y}{x} = q$$

$$q^2 + q - 2 = 0$$

$$D = 1 + 8 = 3^2$$

$$q_{1,2} = \frac{-1 \pm 3}{2}$$

$q_1 = -2$ (посл.)

$q_2 = 1$ (2-й рад)

$q_1 = -2$

41 - 47 (2 уч. из 5 учащ.)

24.11.05р. Литература 41.

$x; y; z; t$

$\div x; y; z$

$\div y; z; t$ $(d < 0)$

$$\begin{cases} y^2 = xz \\ 2z = y + t \\ x + t = 7 \\ y + z = 6 \\ z - t < 0 \end{cases} \Rightarrow \begin{cases} x = \frac{y^2}{z} = \frac{y^2}{6-y} \\ t = 7 - x = 7 - \frac{y^2}{6-y} \\ z = 6 - y \\ 2(6-y) = y + 7 - \frac{y^2}{6-y} \end{cases}$$

$$12 - 2y = \frac{6y - y^2 + y2 - 7y - y^2}{6 - y}$$

$$y2 - 12y - 12y + 2y^2 - 6y + y^2 - y2 + 7y + y^2 = 0$$

$$4y^2 - 23y + 30 = 0$$

$$D = 529 - 480 = 49 = 7^2$$

$$y_{1;2} = \frac{23 \pm 7}{8} \begin{cases} 2 \\ 3\frac{3}{4} \end{cases}$$ (для решения)

$$\begin{cases} y^2 = xz \\ 2x = y + z \\ y = \frac{y}{x} \end{cases} \Rightarrow \begin{cases} x = \frac{y^2}{z} = \frac{y^2}{2x - y} \\ z = 2x - y \end{cases}$$

$$q = \frac{y}{x} = \frac{y(2x - y)}{y^2} = \frac{2x - y}{y}$$

? №2. $\div$ x; y; z q - ?

$\div$ y; x; z

$$x_1 = \frac{y^2}{6 - y} = \frac{y}{y} = 1 \qquad x_2 = \frac{3,75^2}{6 - 3,75} = 6,25$$

$$z_1 = 6 - y = y \qquad z_2 = 6 - 3,75 = 2,25$$

$$L_1 = 6 \qquad L_2 = 7 - 6,25 = 0,75$$

Ответ:

43. $a_1; a_1+d; a_1+2d$, прогрес $a_1=1$

$a_1; a_1+d+3; (a_1+2d)^2$?

$(a_1+d+3)^2 = a_1(a_1+2d)^2$

$(d+4)^2 = (2d+1)^2$

$d^2+16+8d = 4d^2+1+4d$

$3d^2-15-4d=0$

$D = 225+48 = 273$ (արմատ չունի)?

44. $x; y; z$ - պրոգրես

$\div x; y; z \ (q>1)$

$\div 2x$

$\div a_1; a_1q; a_1q^2 \ (q>1)$

$\div 2a_1; a_1q; a_1q^2-13$

$\div x; y; z \ (q>1)$ $xyz=27$

$\div 3x; y; z-13$

$$\begin{cases} xyz=27 \\ y^2=xz \\ 2y=3x+z-13 \end{cases} \Rightarrow \begin{cases} y^3=27 \Rightarrow y=3 \\ y^2=xz \\ 2y=3x+z-13 \end{cases} \Rightarrow \begin{cases} xz=9 \\ 3x+z=18 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} 18x-3x^2=9 \\ z=18-3x \end{cases} \Rightarrow$$

$\Rightarrow 3x^2 - 18x + 9 = 0$

$x^2 - 6x + 3 = 0$

? $\quad D = 36 - 12 = 24$ шүүлтүүр үгүй гэж үзлээ

45 $\div x, y, z \quad (d > 0)$

$\div \div a_1,\ a_1 + d;\ a_1 + 2d \quad (d > 0)$

$\div\div a_1 + 1;\ a_1 + d + 1;\ a_1 + 2d + 21$

$a_1 + a_1 + d + a_1 + 2d = 42$

$3a_1 + 3d = 42$

$a_1 + d = 14$

43. $\div 1;\ d+1;\ 2d+1$

$\div\div 1;\ d+4;\ 4d^2 + 4d + 1$

$d + 4 = \sqrt{(2d+1)^2}$

$d + 4 = 2d + 1$

$d = -3$

$a_1 = 1$ $\quad \div\div 1; -2; -5.$

$a_2 = -2$

$a_3 = -5$

44. $\div x; y; z \ (q>1)$ $\quad xyz=27$

$\div 2x; y; z-13$

$q-?$

$$\begin{cases} y^2 = 2xz - 26x \\ 2y = x+z \\ xyz = 27 \end{cases} \Rightarrow \begin{cases} y^2 = 4xy - 2x^2 - 26x \\ z = 2y - x \end{cases} \Rightarrow$$ квадратное уравнение

45. $a; a_1+d; a_1+2d$ — $a_1 -)$

$$\Rightarrow \begin{cases} \left(\frac{27}{xz}\right)^2 = 2xz - 26x \\ \frac{54}{xz} = x+z \\ y = \frac{27}{xz} \end{cases} \Rightarrow \begin{cases} 2x^3z^3 - 26x^3z^2 = 729 \\ x^2z + xz^2 = 54 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} 2x^2z^2(xz - 13x) = 729 \\ xz(x+z) = 54 \end{cases} \Rightarrow 2x^2z \cdot \frac{z-13}{x+z} = 13{,}5$$

$$x^2 = \frac{13{,}5}{2z}.$$

45. $\div a_1; a_1+d; a_1+2d \ (d>0)$

$\div a_1+1; a_1+d+1; a_1+2d+21$

$a_1 + a_1 + d + a_1 + 2d = 42$

$3a_1 + 3d = 42$

$a_1 + d = 14$

$d = 14 - a_1$

$15^2 = (35+d)(a_1+1)$

$35a_1 + 35 + a_1d + d = 225$

$35a_1 + 35 + 14a_1 - a_1^2 + 14 - a_1 = 225$

$a_1^2 + 48a_1 - 49 = 0$

$D = 576 + 49 = 25^2$

$a_{1;2} = 24 \pm 25$ ⟨ 49, -1 — zh pml

$d = 15$

÷ $a_1 = -1;\ a_2 = 14;\ a_3 = 29$

Тип: 29

46. — $b_1 : b_2 ; b_3$ $\quad b_1 ; b_1q ; b_1q^2$

÷ $b_1 ; 2b_2 ; 4b_3$ $\quad b_1 ; 2b_1q ; 4b_1q^2$

$\Leftrightarrow b_1q \neq$

47. ÷ $a_1 ; a_1+d ; a_1+2d \quad (d>0)$

÷ $a_1-5 ; a_1+d-4 ; a_1+2d$

$$\begin{cases} a_1 + a_1 + d + a_1 + 2d = 30 \\ (a_1 + d - 4)^2 = (a_1 - 5)(a_1 + 2d) \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} a_1 + d = 10 \\ (10 + d)(a_1 - 5) = 36 \end{cases} \Rightarrow \begin{cases} a_1 = 10 - d \\ (10+d)(5-d) = 36 \end{cases}$$

$50 - 10d + 5d - d^2 = 36$

$d^2 + 5d - 14 = 0$

$D = 25 + 56 = 81$

$d_{1;2} = \frac{-5 \pm 9}{2} \begin{cases} -7 \text{ (zh emes)} \\ 2 \end{cases}$

$a_1 = 8 \; ; \; a_2 = a_1 + d = 10 \; ; \; a_3 = 12$

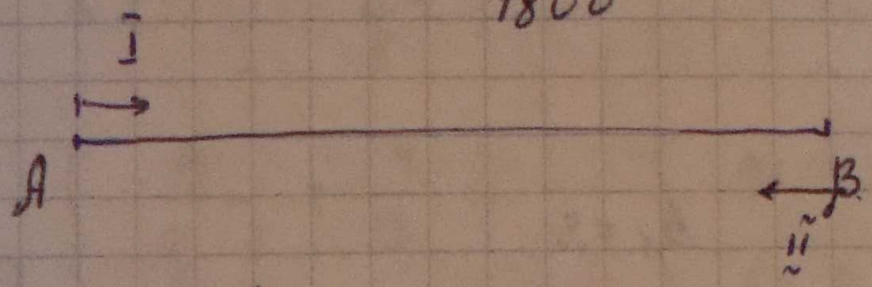
÷ $x+3 \; ; \; 2x-5 \; ; \; 4x-1$ 1988

$\quad \| \qquad \| \qquad \|$

$a_5 \qquad a_{13} \qquad a_{22}$

$x - ?$

1805



2056

~~1 / n 4~~

I 125 l/l ⇒

II I l/n 4. 20 s

Zmq. hmq. l/n 4 25 . ml/t l/h

$\begin{cases} a_1 = 20 \\ d = 2 \end{cases} \Big| \; n - ? \; \Big| \; 12n \; s$

n l/n 4 . ms $\frac{2a_1 + (n-1)d}{2} \cdot n = Sn.$

X

$12n + \frac{2a_1 + (n-1)d}{2} \cdot n = 180$

$24n + 40n + 2n^2 - 2n = 180 \cdot 2$

$12n + 20n + n^2 - n = 180$

$n^2 + 31n - 180 = 0$

$D = 961 + 720 = 1681 = 41^2$

$n_{1,2} = \frac{-31 \pm 41}{2}$ $\begin{matrix} -\frac{72}{2} \text{ (zh ouu!)} \\ < \\ 5 \text{ дн.} \end{matrix}$

Отв: 5 дн.

27.11.05р. Прогрессии/геометр. 1970, 1973, 1978, 1982, 1989, 19 2004, 2006, 2012, 2014, 2020; 2026; 2029. 2051 - 2059

1970. ÷

$b_1 = 3$

$b_3 - b_2 = 6$

q - ?

~~Решение~~

$b_3 - b_2 > 0 \Rightarrow$

q

Пусть $q = -1$

$b_3 = b_1 q^2 = 3 \cdot 1 = 3$

$b_2 = b_1 q = -3$

$b_3 - b_2 = 6$

$b_1 = 3$

$b_1 q^2 - b_1 q = 6$

$3q^2 - 3q - 6 = 0$

$q^2 - q - 2 = 0$

$D = 1 + 8 = 9$

$q_{1,2} = \frac{1 \pm 3}{2}$ $\begin{matrix} -1 \\ < \\ 2 \end{matrix}$

Пусть $q = 2$

$b_3 = 3 \cdot 4 = 12$

$b_2 = 3 \cdot 2 = 6$

$b_3 - b_2 = 6$

1973. $b_2 + b_3 + b_4 = 84$

$b_4 - b_1 = 63$

$q - ?$

$$\begin{cases} b_2 + b_3 + b_4 = 84 \\ b_4 - b_1 = 63 \end{cases} \Rightarrow \begin{cases} b_1 q + b_1 q^2 + b_1 q^3 = 84 \\ b_1 q^3 - b_1 = 63 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} b_1 q (1 + q + q^2) = 84 \\ b_1 = \dfrac{63}{q^3 - 1} \end{cases} \Rightarrow \begin{cases} \dfrac{63q}{(q-1)(q^2+q+1)} \cdot (q^2+q+1) = 84 \\ b_1 = \dfrac{63}{q^3-1} \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} \dfrac{q}{q-1} = \dfrac{4}{3} \\ b_1 = \dfrac{63}{q^3-1} \end{cases} \Rightarrow \begin{cases} q = 4 \\ b_1 = 1 \end{cases}$$ Ответ: $q = 4$.

1978. $(b_6)^2 \cdot b_{18} = 125$

$(b_1 q^5)^2 \cdot b_1 q^{17} = 125$

$b_1^2 q^{10} \cdot b_1 q^{17} = 125$ $\quad b_{10} = b_1 q^9$

$b_1 q^9 (b_1 q \cdot q^8) = 125$

$b_1 q^9 \cdot b_1 q^9 = 125$

$(b_1 q^9)^2 = 125$

$b_1 q^9 =$ $\quad b_1^3 q^{27} = 125$

$(b_1 q^9)^3 = 125$ $\quad b_1 q^9 = 5$ Ответ: 5

1982. $\div$ $x-1$; $3x+1$, $4x$

a_{11} a_{17} a_{25}

$$\begin{cases} a_1 + 10d = x-1 \\ a_1 + 16d = 3x+1 \\ a_1 + 24d = 4x \end{cases} \Rightarrow \begin{cases} d = \frac{x+1}{3} \\ a_1 = -2d \\ 22d = 4x \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} d = \frac{(x+1)}{3} \\ \frac{22x+22}{3} - 4x = 0 \end{cases} \Rightarrow \begin{cases} d = \frac{x+1}{3} \\ a_1 = \frac{7(x+1)}{3} \end{cases}$$

$22x + 22 - 12x = 0$

$7x = -11$

$10x + 22 = 0$

$x = -\frac{11}{7}$

$x = -11$

Ответ:

1989 $\div$ $x-5$, $3x-1$, $5-2x$

a_3 a_9 a_{13}

$$\begin{cases} a_1 + 2d = x-5 \\ a_1 + 8d = 3x-1 \\ a_1 + 12d = 5-2x \end{cases} \Rightarrow \begin{cases} d = \frac{x+2}{3} \\ a_1 = \frac{x-19}{3} \\ \frac{x-19}{3} + 4x + 8 = 5-2x \end{cases}$$

$x - 19 + 12x + 24 - 15 + 6x = 0$

$21x - 10 = 0$

$x = \frac{10}{21}$

ч. $a_1 + 2d = x - 5$

$\frac{x-19}{3} + \frac{2x+4}{3} = \frac{10}{21} - 5$

$\frac{x-19+2x+4}{3} = -\frac{95}{21}$

$\frac{3x-15}{3} = -\frac{95}{21}$

$x - 5 \quad \frac{10}{21} - 5 = -\frac{95}{21}$

$-\frac{95}{21} = -\frac{95}{21}$

* 2004. $\div \sqrt{7-x}\ ;\ x\ ;\ 1+x$

$(a_1 + d)$

$a_1 = \sqrt{7}$

$$\begin{cases} a_1 = \sqrt{7-x} \\ a_2 = \sqrt{7-x} + d = x \\ a_3 = \sqrt{7-x} + 2d = x + 1 \end{cases}$$

$(x = \sqrt{(\sqrt{7-x})(1+x)}; = (\sqrt[4]{7-x})(1+x))$

$x = \frac{1+x+\sqrt{7-x}}{2}$

$(a_1+d)^2 =$

$\div x ; y ; z$

$= x+3 ; y ; z-1$

$$\begin{cases} y = \frac{x+z}{2} \\ y^2 = (x+3)(z-1) \\ \frac{y}{x+3} = 2 \end{cases} \quad \begin{cases} x = \frac{y-6}{2} \\ z = 2y - x \\ y^2 = \left(\frac{y-6}{2}+3\right)\left(\frac{3y+6}{2}-1\right) \end{cases}$$

$z = 2y - \frac{y-6}{2} = \frac{3(y+6)}{2}$

$\sqrt{x+7}, \sqrt{x-5}; 1$

$(\sqrt{x-5})^2 = \sqrt{x+7}$

$x - 5 = \sqrt{x+7}$

$x^2 - 10x + 25 = x + 7$

$x^2 - 11x + 18 = 0$

$\Delta = 121 - 72 = 49$

$x_{1;2} = \frac{11 \pm 7}{2} \begin{matrix} 2 \\ 9 \end{matrix}$ (zh pust.)

$\Pi_{\text{пр.}} \; x = 9$

$2012 \div a_1, a_1+d, a_1+2d$

$= a_1+3; a_1+d; a_1+2d-1$

$$y^2 = \frac{y}{2} \cdot \frac{3y+4}{2} = \frac{3y^2+4y}{4}$$

$$4y^2 - 3y^2 - 4y = 0$$

$$y^2 - 4y = 0$$

$$y(y-4) = 0$$

$$\left[\begin{array}{l} y = 0 \text{ (th cmf.} \\ y = 4 \Rightarrow x = -1;\ z = 9 \end{array}\right.$$

$\div$ $-1; 4; 9$

$\div$ $2; 4; 8$

2014. $\div$ $x; y; z$

$\div$ $x; y; z-2$ $(d=2)$

$$\begin{cases} y^2 = xz \\ 2y = x + z - 2 \\ y - x = 2 \end{cases} \Rightarrow \begin{cases} x = y-2 \\ z = 2y - x + 2 = 2y - y + 2 + 2 = y + 4 \\ y^2 = (y-2)(y+4) \end{cases}$$

$$y^2 = y^2 + 2y - 8$$

$$2y - 8 = 0$$

$$y = 4 \Rightarrow x = 2;\ z = 8$$

$\div$ $2; 4; 8$

$$S_3 = \frac{b_1(q^n - 1)}{q-1} = \frac{2(8+1)}{1} = 14$$ Ответ: 14.

2020. $\div x,y;z$

$\div x-y;y;z$

$$\begin{cases} 2Oz - z^2 - 6y = 0 \\ z^2 - 2Oz + 6y = 0 \end{cases}$$

$z_{1;2} = 10 \pm 6 \begin{matrix} \nearrow 16 \\ \searrow 4 \end{matrix}$

$X \begin{matrix} \nearrow 16 \\ \searrow 4 \end{matrix}$

$\div y;8;16$ $(q=2)$ $(2h\ pmq)$ dwzlh np $0 \nearrow 0<q<2$

$\div 16;8;4$ $(q \geq 0,5)$

$$\begin{cases} y^2 = xz \\ 2y = x - y + z \\ x + y + z = 28 \end{cases} \Rightarrow \begin{cases} x = 28 - y - z = 28 - y - 2y + x - y \\ z = 2y - x + y \\ y^2 = xz \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} 2y - 3y = 0 \\ x = \frac{y^2}{z} \\ z = 2y - \frac{y^2}{z} + y^2 \end{cases} \Rightarrow \begin{cases} y = 8 \\ x + z = 2O \\ xz = 6y \end{cases} \Rightarrow$$

$\Rightarrow \begin{cases} x > 2O - z \end{cases}$

2026

$99 < b_1; b_2; b_3 \dots < 1000)$

2025 $q = 11.$

$b_1 = 11$

$0 < b_n < 1000$

$0 < b_1 q^{n-1} < 1000$

$0 < 11 \cdot 11^{n-1} < 1000$

$0 < 11^n < 1000$

$n < 3$

$n = 2$

$S_n = \frac{b_1(q^3-1)}{q-1} \cdot n =$

$= \frac{11(8-1)}{1} \cdot 77.$

2026. $99 < a_1; a_2; a_3; \dots a_n < 1000$

$a_1 = 103$

$d = 9$

$a_n = 994$

$a_n = a_1 + (n-1)d$

$n = \frac{a_n - a_1}{d} + 1 = \frac{994 - 103 + 9}{9} = 100$

$S'_n = \frac{2a_1 + (n-1)d}{2} \cdot n = \frac{206 + 891}{2} \cdot 100 =$

$= 1097 \cdot 50 = 55130$

2029 $66 < a_1; a_2; \dots a_n < 423$

$a_1 = 68$

$a_n = 422$

$d = 2$ $\quad a_n = a_1 + (n-1)d$

$n = \frac{a_n - a_1}{d} + 1 = \frac{354}{2} + 1 = 207 + 1 = 208$ (178)

$S_n = \frac{2a_1 + (n-1)d}{2} \cdot n = (46 + 414) = \frac{422 + 68}{2} \cdot 178 =$

$= 264110$

1931. $a_3 + a_7 = 18$

$a_4 + a_8 = 21$

S_{13} - ?

$$\begin{cases} a_1 + 2d + a_1 + 6d = 18 \\ a_1 + 3d + a_1 + 7d = 21 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} a_1 + 4d = 9 \\ a_1 + 5d = \frac{21}{2} \end{cases} \Rightarrow \begin{cases} d = \frac{21}{2} - 9 = 1,5 \\ a_1 = 3 \end{cases}$$

$S_{13} = \frac{2 \cdot 3 + 12 \cdot 1,5}{2} \cdot 13 = 156$

1932. $\vec{a_2} + a_5 = 8$ | a_1 - ?

$S_{10} = 60$ |

2029 $66 < a_1; a_2; \dots a_n < 423$

$a_1 = 68$

$a_n = 422$

$d = 2$ $\quad a_n = a_1 + (n-1)d$

$$n = \frac{a_n - a_1}{d} + 1 = \frac{354}{2} + 1 = 207 + 1 = 208$$

178

$$S_n = \frac{2a_1 + (n-1)d}{2} \cdot n = (116 + 414) = \frac{422 + 68}{2} \cdot 178 =$$

$= 264110$

1931. $a_3 + a_7 = 18$

$a_4 + a_8 = 21$

$S_{13} - ?$

$$\begin{cases} a_1 + 2d + a_1 + 6d = 18 \\ a_1 + 3d + a_1 + 7d = 21 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} a_1 + 4d = 9 \\ a_1 + 5d = \frac{21}{2} \end{cases} \Rightarrow \begin{cases} d = \frac{21}{2} - 9 = 1{,}5 \\ a_1 = 3 \end{cases}$$

$$S_{13} = \frac{2 \cdot 3 + 12 \cdot 1{,}5}{2} \cdot 13 = 156$$

1932. $\vec{a_2} + a_5 = 8 \mid a_1 - ?$

$S_{10} = 60$

$$\begin{cases} a_1 + d + a_1 + 4d = 8 \\ 2a_1 + 8d = 12 \end{cases} \Rightarrow \begin{cases} a_1 + 2{,}5d = 4 \\ a_1 + 4d = 6 \end{cases} \Rightarrow 1{,}5d = 2$$

$$d = 4/3$$

$$a_1 = 6 - \frac{16}{3} = \frac{2}{3}$$

$$a_7 = a_1 + 6d = \frac{2}{3} + 6 \cdot \frac{4}{3} = \frac{2}{3} + 8 = \frac{26}{3} = 8\frac{2}{3}$$

1933. $S_6 = 36$

$S_{10} = 40$

a_5 - ?

$$\begin{cases} 2a_1 + 5d = 12 \\ 2a_1 + 8d = 8 \end{cases} \Rightarrow \begin{cases} 4d = -4 \Rightarrow d = -1 \\ a_1 = 8{,}5 \end{cases}$$

$$a_5 = a_1 + 4d = \frac{17}{2} - 4 = \frac{9}{2} = 4{,}5$$

1960. $2a_5 + S_7 + a_{32} = 15$

a_7 - ?

$a_7 = a_1 + 6d$

$$2a_1 + 8d + \frac{2a_1 + 6d}{2} \cdot 7 + a_1 + 31d = 15$$

$$4a_1 + 16d + 14a_1 + 42d + 2a_1 + 62d = 30$$

$$20a_1 + 120d = 30$$

$$a_1 + 6d = 1{,}5 = a_7$$

Ответ: $a_7 = 1{,}5$

1961. $b_5 = 8\,4$

$b_8 = \frac{27}{2}$

$b_6 - ?$

$$\begin{cases} b_1 q^4 = 4 \\ b_1 q^7 = \frac{27}{2} \end{cases} \Rightarrow \begin{cases} q = 1{,}5 \\ b_1 = \frac{1600}{2031} \end{cases}$$

$$a_6 = b_1 q^5 = \frac{1600}{2031} \cdot (1{,}5)^5$$

1980. $S_2 = 3$

$S_6 = 63$

$q - ?$

$$S_n = \frac{b_1 (q^2 - 1)}{q - 1}$$

$$\begin{cases} \frac{b_1 (q^2 - 1)}{q - 1} = 3 \\ \frac{b_1 (q^6 - 1)}{q - 1} = 63 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} b_1 q^2 - b_1 = 3q - 3 \\ b_1 q^6 - b_1 = 63q - 63 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} b_1 = \frac{3(q-1)}{(q-1)(q+1)} = \frac{3}{q+1} \\ \frac{3}{(q+1)} \cdot \frac{3(q^3+1)(q^3-1)}{(q-1)} = 63 \end{cases}$$

1,5
1600
2031

$$\frac{3(q+1)(q^2-q+1)(q-1)(q^2+q+1)}{(q+1)(q-1)} = 63$$

$$3(q^2-q+1)(q^2+q+1) = 63$$

$$(q^2-q+1)(q^2+q+1) = 21$$

$$q^4 + q^3 + q^2 - q^3 - q^2 - q + q^2 + q + 1 = 21$$

$$q^4 + q^2 + 20 = 0$$

$$q^2 = x$$

$$x^2 + x - 20 = 0$$

$$d = 1 + 80 = 81$$

$$x_{1;2} = \frac{-1 \pm 9}{2} \quad \begin{matrix} -5 \\ 4 \end{matrix}$$

$$q^2 = x_1$$

$$q^2 = -5 \quad q \in \varnothing$$

$$q^2 = 4$$

$$q = \pm 2$$

1981. $2x;\ x+2;\ 3x-1$

$a_{11}\quad a_{17}\quad a_{25}$

$$\begin{cases} a_1 + 10d = 2x \\ a_1 + 16d = x + 2 \\ a_1 + 24d = 3x - 1 \end{cases} \Rightarrow \begin{cases} 4d = 2 - x \\ a_1 = 5(2-x) - 2x - \frac{5(2-x)}{2} \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} d = \frac{2-x}{4} \\ a_1 = \frac{4x - 10 + 5x}{2} \end{cases} \Rightarrow \text{a} \quad \frac{9x-10}{2} + \frac{10-5x}{2} = 2x$$

$$9x - 10 + 10 - 5x = 4x$$

$$\frac{9x-10}{2} + 12 - 6x = 3x - 1$$

$$9x - 10 + 24 - 12x = 6x - 2$$

$$9x - 12x - 6x - 10 + 24 + 2 = 0$$

$$16 - 9x = 0$$

$$9x = 16$$

$$x = \frac{16}{9}$$

1986. $2 - x;\ 3x + 1,\ 4x - 1$

$a_{10}\quad a_{15}\quad a_{23}$

$$\begin{cases} a_1 + 9d = 2 - x \\ a_1 + 14d = 3x + 1 \\ a_1 + 24d = 4x - 1 \end{cases} \Rightarrow \begin{cases} 5d = 3x + 1 - 2 + x \\ a_1 = 2 - x - 9d \\ a_1 + 24d = 4x - 1 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} d = \frac{4x-1}{5} \\ a_1 = \frac{10 - 5x - 36x + 9}{5} \\ a_1 + 24d = 4x - 1 \end{cases} \Rightarrow \begin{cases} d = \frac{4x-1}{5} \\ a_1 = \frac{19 + 41x}{5} \end{cases}$$

$$\frac{19 + 41x}{5} + \frac{456 + 984x}{5} = 4x - 1$$

$$19 + 41x + 456 + 984x - 20x + 5 = 0$$

$$1005x = 480 \qquad x = \frac{480}{1005} = \frac{32}{67}$$

1990. $2x+1;\ 3x-1;\ x-5$ ÷

$\|\quad\|\quad\|$

$a_7 \quad a_{14} \quad a_{20}$

$$\begin{cases} a_1+6d=2x+1 \\ a_1+13d=3x-1 \\ a_1+19d=x-5 \end{cases} \Rightarrow \begin{cases} d=\frac{x-2}{7} \\ a_1=\frac{21x-7-13x+26}{7} \Rightarrow \\ a_1+19d=x-5 \end{cases}$$

$$\Rightarrow \begin{cases} d=\frac{x-2}{7} \\ a_1=\frac{8x+19}{7} \\ \frac{8x+19}{7}+\frac{19x-38}{7}=2x-5 \end{cases}$$

$8x+19+19x-38=7x-35$

$20x+16=0$

$(5x+4=)\quad x=-\frac{4}{5}=-0,8$

2003. $\div\sqrt{5x+1};\ 2x;\ 3x+1$

$4x=3x+1+\sqrt{5x+1}$

$x-1=\sqrt{5x+1}$

$x^2+1-x=5x+1$

$x^2-6x=0$

$x(x-6)=0$

$\left[\begin{array}{l} x=0 \\ x=6 \end{array}\right.$

2004 ÷ $\sqrt{7-x}$; x ; 1+x

$2x = \sqrt{7-x} + 1 + x$

$x - 1 = \sqrt{7-x}$

$x^2 - x + 1 = 7 - x$

$x^2 - 6 = 0$

$x = \sqrt{6}$

2006. ÷ $\sqrt{x+7}$; $\sqrt{x-5}$; 1

$\left(\sqrt{x-5}\right)^2 = \sqrt{x+7}$.

$x - 5 = \sqrt{x+7}$

$x^2 + 25 - 10x = x + 7$

$x^2 - 11x + 18 = 0$

$D = 121 - 72 = 49$

$x_{1;2} = \frac{11 \pm 7}{2}$ < $\frac{9}{2}$ (2 кор.)

Ответ: $x = 9$.

2007. $(\sqrt{2})^{x^2}$; $\sqrt[4]{8}$; 2^{-x}

$(\sqrt[4]{8})^2 = (\sqrt{2})^{x^2} \cdot 2^{-x}$

$\sqrt{8} = (\sqrt{2})^{x^2-2x}$

$2^{x^2-2x} = 2^3$

$x^2 - 2x = 3$

$x^2 - 2x - 3 = 0$

$D = 4 + 12 = 16$

$x_{1;2} = \frac{2 \pm 4}{2} \begin{matrix} 3 \\ -1 \end{matrix}$

2009. $(\sqrt{3})^{x^2}$; $\sqrt[4]{3^{x+4}}$; 3^{-x}

$(\sqrt[4]{3^{x+4}})^2 = 3^{-x} \cdot (\sqrt{3})^{x^2}$

$\sqrt{3^{x+4}} = \sqrt{3}^{x^2-2x}$

$3^{x+4} = 3^{x^2-2x}$

$x + 4 = x^2 - 2x$

$x^2 - 3x - 4 = 0$

$D = 9 + 16 = 25$

$x_{1;2} = \frac{3 \pm 5}{2} \begin{matrix} -1 \\ 4 \end{matrix}$

$x = 7$ ✗

$y = y$

$z = 1$

2012. $\div x; y; z$

$= x+3; y; z-1$

$\begin{cases} 2y = zx+z \\ y^2 = (x+3)(z-1) \\ \frac{y}{x+3} = 2 \end{cases} \Rightarrow \begin{cases} x = \frac{y-6}{2} \\ z = 2y - xz = \frac{3y+6}{2} \\ y^2 = \left(\frac{y-6}{2}+3\right)\left(\frac{3y+6}{2}-1\right) \end{cases}$

$d > 0$

2011. $\div x; y; z$

$= x; y; z+2$

$\begin{cases} 2y = xz \\ y^2 = x(z+2) \\ x+y+z = 12 \end{cases} \Rightarrow \begin{cases} x = 2y - z \\ 3y = 12 \\ y^2 = xz + 2x \end{cases}$ (2)

$\begin{cases} x = 8 - z \\ y = y \\ 8z - z^2 + 8z = 96 \end{cases} \Rightarrow$

$\Rightarrow \begin{cases} x = 8 - z \\ y = y \\ z^2 + 7z - 8 = 0 \end{cases}$

$b = 49 + 32 = 81$

$z_{1;2} = \frac{-7 \pm 9}{2} \quad \begin{matrix} -8 \text{ (không thuộc)} \\ 1 \text{ (thỏa mãn)} \end{matrix}$

$y^2 = \frac{y}{2} \cdot \frac{3y+4}{2}$

$4y^2 - 3y^2 - 4y = 0$

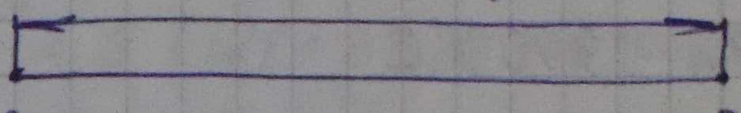
$y^2 - 4y = 0$

$y(y-4) = 0$

$\left[\begin{array}{l} y = 0 \quad (\text{не подх.}) \\ y = 4 \Rightarrow x = -1;\ z = 9 \end{array}\right.$

8468.

2051.



a) $I\ d - 15\,45$

$II\ d - (15-1)\,45 + 15\,45$

. . . . .

$n\ d -$

$\frac{2 \cdot 15 + 1 - n}{2} \cdot n = 84$

$n\left(\frac{31-n}{2}\right) = 84$

$31n - n^2 = 168$

$n^2 - 31n + 168 = 0$

$D = 961 - 672 = 289 = 17^2$

$n_{1;2} = \frac{31 \pm 17}{2}$ ⟨ 24 (не подх.)

7 (подх.)

7 дн.

$D = 4761 + 5880 = 10641$

$n_{1;2} = \frac{-49 \pm 91}{2} \begin{cases} -70 \text{ (не подх.)} \\ 21 \end{cases}$

Ответ: $n = 21$

2052. $a_1 = 50$

$d = 2$

$n - ?$

$S_n = 1470$

$\frac{100 + 2n-2}{2} \cdot n = 1470$

$98n + 2n^2 = 2940$

$2n^2 + 98n - 2940 = 0$

$n^2 + 49n - 1470 = 0$

$D = 2401 + 5880 = 8281 = 91^2$

$n_{1;2} = \frac{-49 \pm 91}{2} \begin{cases} -70 \text{ (не подх.)} \\ 21 \end{cases}$

Ответ: $n = 21$

2053. $a_1 = 800(\text{г})$

$d = -25$

$S_n = 5100$

$\frac{1600 - 25n + 25}{2} \cdot n = 5100$

$n(64 - n + 1) = 456$

$n^2 - 65n + 456 = 0$

$D = 4225 - 1824 = 2401 = 49^2$

$n_{1;2} = \frac{65 \pm 49}{2} \begin{cases} 57 \text{ (г.р.)} \\ 8 \end{cases}$

Ответ: 8 дней

2054. I q. | шүүлтүүр - е 70 ш/ц | S | нэмэгд.
II q. | I ц-нд 50 ш | 486 | n ц. нэгэн

II ц-нд 140 м/ц-ээр нэмэгдэнэ

$$70n + \frac{2\cdot 50 + n-1}{2}\cdot n = 486$$

$$140n + 100n + n^2 - n = 972$$

$$n^2 + 239n - 972 = 0$$

$$D = 57121 + 3888 = 61009 = 247^2$$

$$n_{1,2} = \frac{-239 \pm 247}{2}$$

-486 (зөв. б.)

8 ц

Тэмцээн 8 ц үргэлжилнэ.

2055: $S = 1535$

$V_1 = 105$ т/ц

II -с I-рүү ирэх - 35

II -нь 55 м/ц-ээр

алгуурлана

n - ?

n ц нүүгээд хөдөлгөөн ижилрэх бөгөөд

$S_n + S_1 = S$

$$\frac{6 + 5n - 5}{2}\cdot n + 10n = 153$$

$$5n^2 + n + 20n = 306$$

$$5n^2 + 21n - 306 = 0$$

$$D = 441 + 6120 = 6561 = 81^2$$

$$n_{1,2} = \frac{-21 \pm 81}{2}$$

-51 (зөв. б.)

30

Тэмцээн 30 ц үргэлжилнэ.

2056. $S = 180$

I – $v_1 = 12$ км/ч

II – x I дн. – 20 км

Зад. выч. – 25 км/ч

n дн. изу. физ-ры

$$12n + \frac{40 + 2n - 2}{2} \cdot n = 180$$

$$12n + 20n + n^2 - n = 180$$

$$n^2 + 31n - 180 = 0$$

$$D = 961 + 720 = 1681 = 41^2$$

$$n_{1;2} = \frac{-31 \pm 41}{2} \begin{matrix} -36 \text{ (т.к.)} \\ < \\ 5 \text{ дн.} \end{matrix}$$

Ответ: 5 дн. изу.

2057. I | 42 км/ч 2-й раз | 9 дн изу | I – 50%

II | 4240 т. | II – на 148 км/ч

$$42(9 + n) = \frac{100 + n - 1}{2} \cdot n$$

$$(378 + 42n)$$

$$756 + 84n = 100n + n^2 - n$$

$(n^2 + 183n)$ $n^2 + 15n - 756 = 0$

$D = 225 + 3024 = 1737 = 57^2$

$n_{1;2} = \frac{-15 \pm 57}{2}$ $\begin{cases} -36 \\ 21 \end{cases}$

Ответ: 21 год.

2058. $S = 144$ км

$v_1 = 12$ км/ч

II – с I д-ник – 7 с

Дано: нач. д-ник – 25 км

$12n + \frac{14 + 2n - 2}{2} \cdot n = 144$

$12n + 7n + n^2 - n - 144 = 0$

$n^2 + 18n - 144 = 0$

$D = 324 + 576 = 900$

$n_{1;2} = \frac{-18 \pm 30}{2}$ $\begin{cases} -24 \text{ (т. к. отр.)} \\ 6 \text{ ч.} \end{cases}$

Ответ: 6 ч нужно.

2060. $S = 45$ км

$v_1 = 30$ км/ч

II – с I д-ник – 30 км

Дано: нач. д-ник – 145 км отстает

$$30n - \frac{60+n+1}{2} \cdot n = 45$$

$$60n - 60n + n^2 - n = 90$$

$$n^2 - n - 90 = 0$$

$$D = 1 + 360 = 361 = 19^2$$

$$n_{1;2} = \frac{1 \pm 19}{2} \begin{cases} -9 \text{ (не удовл.)} \\ 10 \text{ д.} \end{cases}$$

Ответ: 10 дней.

2060 $V_1 = 15$ т/ч.

$\frac{1}{2}$ ч – 1 ч – ? т – ?

Пусть вся т – 1 ч – ? часть

$$15n - \frac{6+n-1}{2} \cdot n = 0$$

$$30n - 6n - n^2 + n = 0$$

$$n^2 - 25n = 0$$

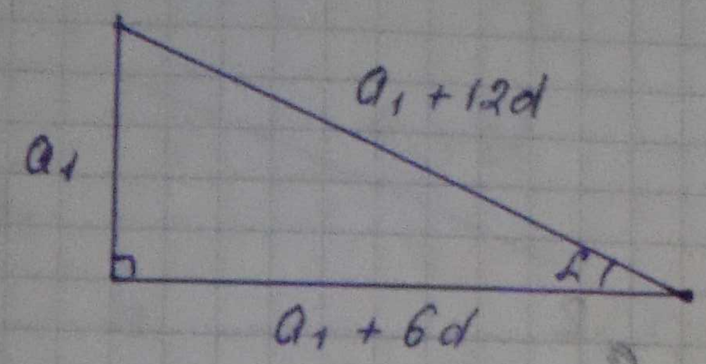
$$\begin{cases} n = 0 \text{ (не удовл.)} \\ n = 25 \end{cases}$$

Ответ: 25 ч.

2061. a_1 ; $a_1 + 6d$; $a_1 + 12d$ $\quad (d > 0)$

$\| \quad \| \quad \|$

$a_1 \quad a_7 \quad a_{13}$



$$a_1^2 + (a_1 + 6d)^2 = (a_1 + 12d)^2$$

$$a_1^2 + a_1^2 + 36d^2 + 12a_1 d = a_1^2 + 144d^2 + 24a_1 d$$

$$a_1^2 - 12a_1 d - 108d^2 = 0$$

$$\left(\frac{a_1}{d}\right)^2 - 12\frac{a_1}{d} - 108 = 0 \qquad \frac{a_1}{d} = 18$$

$$x^2 - 12x - 108 = 0 \qquad a_1 = 18d \Rightarrow$$

$$D = 36 + 108 = 144 \qquad \Rightarrow a_7 = 18d + 6d = 24d$$

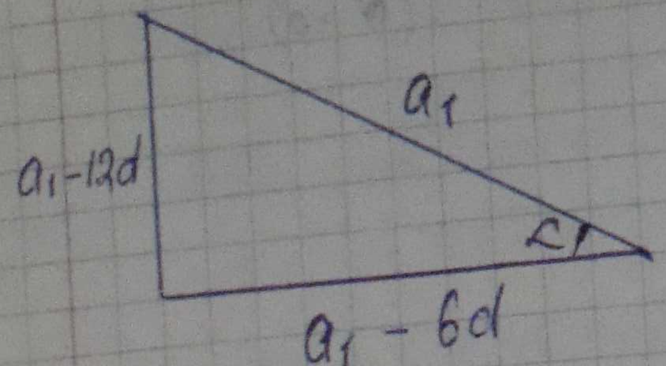
$$x_{1;2} = 6 \pm 12 \begin{matrix} \nearrow 18 \\ \searrow -6 \text{ (не подх.)} \end{matrix} \qquad a_{13} = 18d + 12d = 30d$$

$$\sin\alpha = \frac{a_1}{a_1 + 12d} = \frac{18d}{30d} = 0{,}6$$

$$\sin(90 - \alpha) = \cos\alpha = \frac{24d}{30d} = 0{,}8$$

Отв. $\quad d > 0$

Upt $d<0$



$$(a_1-12d)^2+(a_1-6d)^2=a_1^2$$

$$a_1^2-24a_1d+144d^2+a_1^2-12a_1d+36d^2=a_1^2$$

$$a_1^2-36a_1d+180d^2=0$$

$$\left(\frac{a_1}{d}\right)^2-36\frac{a_1}{d}+180=0$$

$$x^2-36x+180=0$$

$$D=324-180=0\ 144$$

$$x_{1;2}=18\pm 12 \begin{cases} 30 \\ 6 \end{cases}$$

$\frac{a_1}{d}=$ 2) $a_1=30d$ (1 ptuyt)

$a_1=6d$ (1 ptuyt) (zh chuc)

2 pt $a_1=30d$

$a_7-12d=18d$

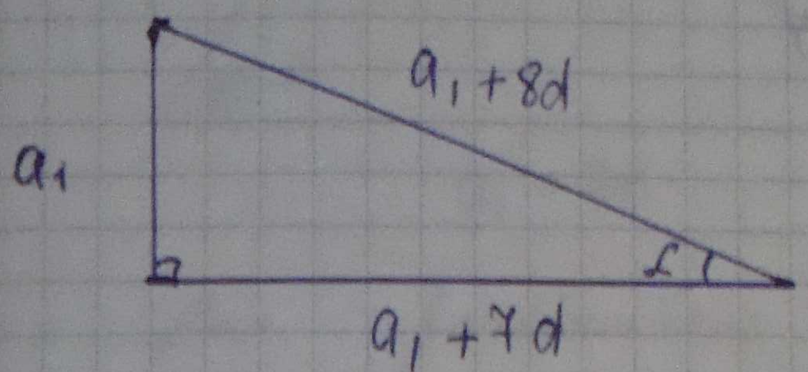
$a_1-6d=24d$

$$\sin\alpha=\frac{18d}{30d}=0,6 \qquad \sin(90-\alpha)=0,8$$

2062. a_1 ; a_1+7d ; a_1+8d $\quad d>0$

$\quad\;\;$ ‖ $\quad\quad$ ‖ $\quad\quad$ ‖

$\quad a_1 \quad\quad a_8 \quad\quad a_9$



$a_1^2 + (a_1+7d)^2 = (a_1+8d)^2$

$a_1^2 + a_1^2 + 14a_1d + 49d^2 = a_1^2 + 16a_1d + 64d^2$

$a_1^2 - 2a_1d - 15d^2 = 0$

$D = 1 + 15 = 16$

$\left(\frac{a_1}{d}\right)^2 - 2\frac{a_1}{d} - 15 = 0$

$x^2 - 2x - 15 = 0$

$\frac{D}{4} = 16$

$x_{1;2} = 1 \pm 4 \lessdot \begin{matrix} 5 \\ -3 \text{ (не подх.)} \end{matrix}$

$\frac{a_1}{d} = 5 \Rightarrow$

$\Rightarrow a_1 = 5d$

$a_1+8d = 13d$

$a_1+7d = 12d$

$\operatorname{tg}\alpha = \frac{a_1}{a_1+7d} = \frac{5d}{12d} = \frac{5}{12}$

Ответ: $\operatorname{tg}\alpha = \frac{5}{12}$

2063. $a_1^2 + a_1^2 + d^2 + 2a_1d = a_1^2 + 4d^2 + 4a_1d$

$$\begin{cases} a_1^2 - 3d^2 - 2a_1d = 0 \\ \frac{a_1^2 + a_1d}{2} = 2y \end{cases} \Rightarrow$$

$$\left(\frac{a_1}{d}\right)^2 + 2\frac{a_1}{d} - 3 = 0$$

$\frac{a_1}{d} = x$

$x^2 - 2x - 3 = 0$

$D = 4 + 12 = 16$

$x_{1,2} = \frac{2 \pm 4}{2}$ — -1 (не удовл.), 3

$$\begin{cases} \frac{a_1}{d} = 3 \\ a_1(a_1 + d) = 48 \end{cases} \Rightarrow \begin{cases} a_1 = 3d \\ 3d(3d + d) = 48 \\ 12d^2 = 48 \\ d^2 = 4 \\ d = \pm 2 \end{cases}$$

-2 (не удовл.) $\Rightarrow$

$\Rightarrow a_1 = 6$

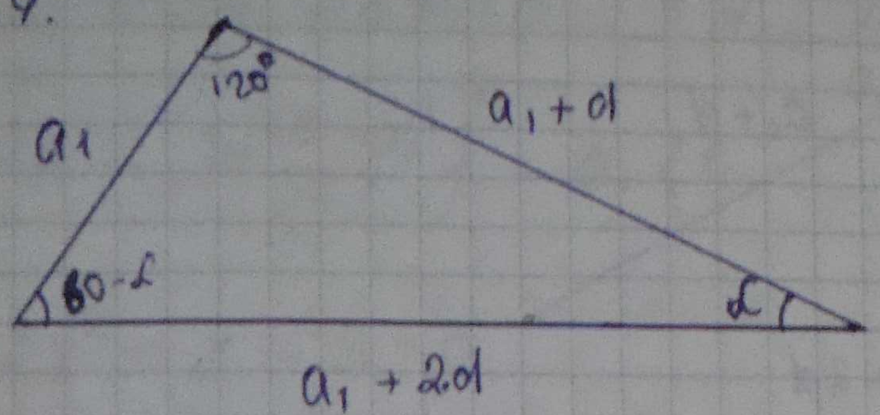
$a_2 = 8$

$a_3 = 10$

Ответ: 6; 8; 10.

2064.

2064.



Сам. $\triangle$ синусов косинусов.

$(a_1+2d)^2 = a_1^2+(a_1+d)^2 - 2a_1(a_1+d)\cos 120^\circ$

$a_1^2 + 4a_1d + 4d^2 = a_1^2 + a_1^2 + 2a_1d + d^2 - (2a_1^2 + 2a_1d)\cdot(-\cos\alpha)$

$a_1^2 - 2a_1d - 3d^2 + 2a_1^2\sin 30^\circ + 2a_1d\sin 30^\circ = 0$

$a_1^2 - 2a_1d - 3d^2 + a_1^2 + a_1d = 0$

$2a_1^2 + a_1d - 3d^2 = 0$

$2\left(\frac{a_1}{d}\right)^2 - \frac{a_1}{d} - 3 = 0$

$2x^2 - x - 3 = 0$

$D = 1 + 24 = 25$

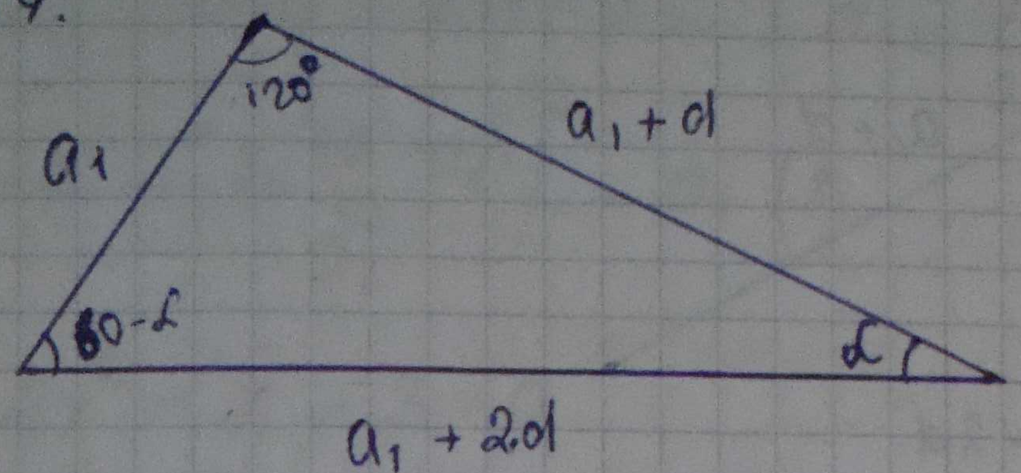
$x_{1,2} = \frac{1\pm 5}{2} \begin{cases} -2 \text{ (не подх.)} \\ 3 \end{cases}$

$a_1 = 3d \Rightarrow \left(\frac{a_1}{a_1+d} = \frac{3d}{3d+d} = \frac{3}{4} = 0{,}75\right)$

$\frac{a_1+2d}{\sin 120^\circ} = \frac{a_1}{\sin\alpha} \Rightarrow \sin\alpha = \frac{a_1\sin 30^\circ}{a_1+2d} = \frac{3d\cdot\frac{\sqrt{3}}{2}}{5d} = \frac{3\sqrt{3}}{5}$

Ответ: $\sin\alpha = \frac{3\sqrt{3}}{5}$

2064.



По теореме косинусов

$$(a_1+2d)^2 = a_1^2+(a_1+d)^2 - 2a_1(a_1+d)\cos 120^\circ$$

$$a_1^2 + 4a_1d + 4d^2 = a_1^2 + a_1^2 + 2a_1d + d^2 - (2a_1^2 + 2a_1d)(-\cos\alpha)$$

$$a_1^2 - 2a_1d - 3d^2 + 2a_1^2\sin 30^\circ + 2a_1d\sin 30^\circ = 0$$

$$a_1^2 - 2a_1d - 3d^2 + a_1^2 + a_1d = 0$$

$$2a_1^2 + a_1d - 3d^2 = 0$$

$$2\left(\frac{a_1}{d}\right)^2 - \frac{a_1}{d} - 3 = 0$$

$$2x^2 - x - 3 = 0$$

$$D = 1 + 24 = 25$$

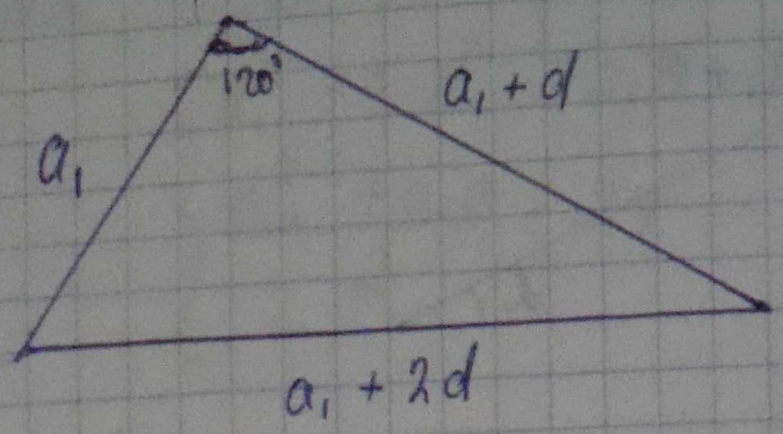
$$x_{1,2} = \frac{1 \pm 5}{2} \begin{cases} -2 \text{ (не подходит)} \\ 3 \end{cases}$$

$$a_1 = 3d \Rightarrow \left(\frac{a_1}{a_1+d} = \frac{3d}{3d+d} = \frac{3}{4} = 0{,}75\right)$$

$$\frac{a_1+2d}{\sin 120^\circ} = \frac{a_1}{\sin\alpha} \Rightarrow \sin\alpha = \frac{a_1\sin 30^\circ}{a_1+2d} = \frac{3d\cdot\sqrt{3}}{5d} = \frac{3\sqrt{3}}{5}$$

Ответ: $\sin\alpha = \frac{3\sqrt{3}}{5}$

2065.



$$S = \frac{1}{2} a_1 (a_1 + d) \sin 120^\circ =$$

$$= \frac{1}{2} a_1 (a_1 + d) \cos 30^\circ =$$

$$= \frac{\sqrt{3} a_1^2 + \sqrt{3} a_1 d}{4} = \frac{5\sqrt{3}}{2}$$

$$\frac{a_1^2 + a_1 d}{2} = 5$$

$$a_1^2 + a_1 d = 10$$

$$a_1 + d = \frac{10}{a_1}$$

$$d = \frac{10 - a_1^2}{a_1} \qquad \frac{10}{a_1} - a_1$$

$$(a_1 + 2d)^2 = a_1^2 + (a_1 + d)^2 + 2a_1 (a_1 + d) \sin 30^\circ$$

$$a_1^2 + 4a_1 d + 4d^2 = a_1^2 + a_1^2 + 2a_1 d + d^2 + a_1^2 + a_1 d$$

$2a_1^2 - 3d^2 - a_1 d = 0 \qquad d = \frac{10}{a_1} - a_1$

$2a_1^2 - 3\left(\frac{10 - a_1^2}{a_1}\right)^2 - a_1(1$

$2x^2 - x - 3 = 0$

$D = 1 + 24 = 25$

$x_{1;2} = \frac{1 \pm 5}{4}$ $\begin{cases} -1 \text{ (не удовл.)} \\ \frac{3}{2} \end{cases}$

$a_1 = \frac{3d}{2}$

$S = \frac{1}{2} a_1 (a_1 + d) \cdot \sin 120^\circ = \frac{1}{2} \cdot \frac{3d}{2} \cdot \frac{\sqrt{3}}{2} \left(\frac{3d}{2} + d\right) =$

$= \frac{3\sqrt{3}d}{8} \cdot \frac{5d}{2} = \frac{15\sqrt{3}d^2}{16}$

$\sqrt{15}\ \frac{15\sqrt{3}}{16} d^2 = \frac{5\sqrt{3}}{2}$

$d^2 = \frac{5\sqrt{3}}{2} \cdot \frac{16}{15\sqrt{3}} = 2\sqrt{\frac{2}{3}} = \frac{2\sqrt{2}}{\sqrt{3}} = \frac{2}{3}\sqrt{6}$

$a_1 = \frac{6\sqrt{2}}{\sqrt{3}} \cdot \frac{1}{2} = \frac{3\sqrt{2}}{\sqrt{3}} = \frac{3\sqrt{6}}{3} = \sqrt{6}$

$a_1 + d = \sqrt{6} + \frac{2}{3}\sqrt{6} = \sqrt{6}\left(1 + \frac{2}{3}\right) = \frac{5\sqrt{6}}{3}$

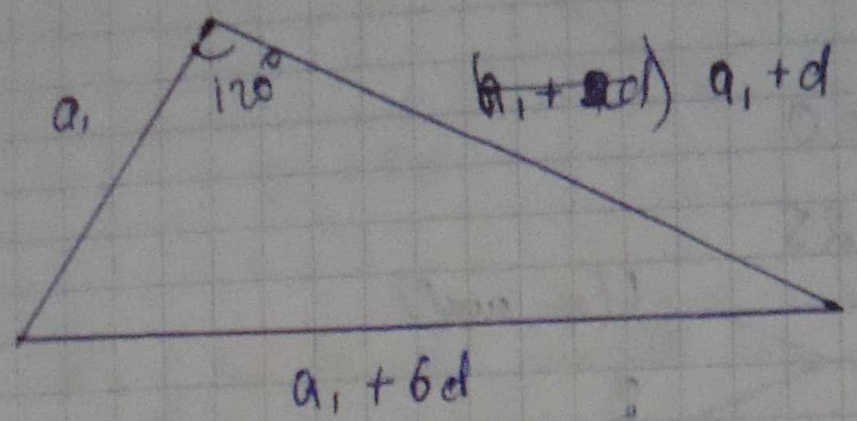
$\sin 30^\circ$

$\frac{3}{2} + a_1 d$

$+ a_1^2 + a_1 d$

$a_1 + 2d = \sqrt{67} + \frac{4}{3}\sqrt{67} = \sqrt{67}\left(1 + \frac{4}{3}\right) = \frac{7\sqrt{67}}{3}$

2066.



$(a_1 + 6d)^2 = a_1^2 + (a_1 + 5d)^2 - 2a_1(a_1 + 5d)\cos 120°$

$a_1^2 + 12a_1d + 36d^2 = a_1^2 + a_1^2 + 10a_1d + 25d^2 + 2a_1(a_1 + 5d)\sin 30°$

$a_1^2 + 12a_1d + 36d^2 = a_1^2 + 10a_1d + 25d^2 + a_1^2 + 5a_1d$

$2a_1^2 - 3a_1d - 11d^2 = 0$

$2x^2 + 3x - 11 = 0.$

$D = 9 + 88 =$

$a_1^2 + 12a_1d + 36d^2 = a_1^2 + a_1^2 + 4a_1d + 4d^2 + a_1^2 + 2a_1d$

$2a_1^2 - 6a_1d - 32d^2 = 0$

$a_1^2 - 3a_1d - 16d^2 = 0$

$x^2 - 3x - 16 = 0$

$D = 9 + 64$

$a_1^2 + 12a_1d + 36d^2 = a_1^2 + a_1^2 + d^2 + 2a_1d + a_1^2 + a_1d$

$2a_1^2 - 9a_1d - 35d^2 = 0$

$2x^2 - 9x - 35 = 0$

$D = 81 + 280 = 361 = 19^2$

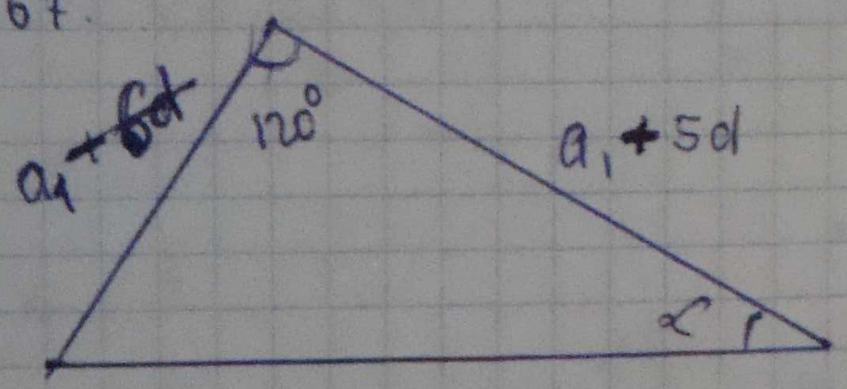
$x_{1;2} = \frac{9 \pm 19}{4} \begin{matrix} 7 \\ -\frac{5}{2} \end{matrix}$ (не подх.)

$\frac{a_1}{d} = 7 \Rightarrow a_1 = 7d$

$\frac{a_1}{a_1 + 6d} = \frac{7d}{7d + 6d} = \frac{7d}{13d} = \frac{7}{13}$

Ответ: $\frac{7}{13}$

2067.



$\div a_1;\ a_1 - 5d;\ a_1 - 6d.$

$d < 0.$

$a_1^2 = a_1^2 - 12a_1d + 36d^2 + a_1^2 + 10a_1d + 25d^2 + a_1^2 - 11a_1d + 30d^2$

$2a_1^2 + 33a_1d + 91d^2 = 0$

$2a_1^2 - 33a_1d + 91d^2 = 0$

$D = 1089 - 364 = 725$

$D = 1089 - 728 = 19^2$

$x_{1;2} = \frac{33 \pm 19}{4} \begin{matrix} 13. \\ 3{,}5. \end{matrix}$

$$\frac{a_1+6d}{\sin\alpha} = \frac{a_1}{\sin 120^\circ}$$

$$\sin\alpha = \frac{\sqrt{3}\,(13d-6d)}{2\cdot 13d} =$$

$$= \frac{\sqrt{3}\cdot 7d}{2\cdot 13d} = \frac{7\sqrt{3}}{26}$$

10 см. сил.

№ 21. I – x км/ч, $\frac{20}{x}$ ч

II – 8 дней = 480 км.

$x+5$ км/ч $\quad (x-20)+5$ км/ч

$\frac{480}{x}$

$x+5$ км/ч $\quad \frac{480}{x}$ ч

$\frac{480}{x-20}$ ч

$$\frac{480}{x} - \frac{480}{x-20} = 2$$

$$\frac{240}{x} - \frac{240}{x-20} = 0$$

$$\frac{240x-4800-240x}{x(x-20)} = 0$$

-480

18. 2. | x | 54. x+5 | $\frac{x+5}{y+5} = \frac{7}{5}$ | 14 шт. x−1 ⟩ 2 вид. ст.
f | y | y+5 | y−1 ⟩

(x+5 y+5) $\frac{x-1}{y-1} = 2$

$$\begin{cases} \frac{x+5}{y+5} = \frac{7}{5} \\ \frac{x-1}{y-1} = 2 \end{cases} \Rightarrow \begin{cases} 5x+25 = 7y+35 \\ 2x-x-1 = 2y-2 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} 5x-7y = 10 \\ x-2y = -1 \\ x = 2y-1 \end{cases} \Rightarrow \begin{cases} x = 2y-1 \\ 10y-5-7y = 10 \\ 3y = 5 \quad 3y = 15 \\ y = 5 \end{cases}$$

$x = 9$

2 бр. 7 мин.
22. 2 пр. | x | 25 | 25−x → 30 м. y+1
2 пеш | 25− | x → 30 м. y

$x+y = 25$

$(25-x)\ \frac{30}{25-x} =$

$\frac{30}{x}$

$\frac{30}{25-x} - \frac{30}{x} = 1$ $\quad x \neq 0$, $x \neq 25$

$\frac{30x - 750 + 30x}{x(25-x)} = 1$

$25x - x^2 = -750$

$x^2 - 25x - 750 = 0$

$D = $

$30x - 750 + 30x - 25x + x^2 = 0$

$x^2 + 35x - 750 = 0$

$D = 1225 + 3000 = 4225 = 65^2$

$x_{1,2} = \frac{-35 \pm 65}{2}$ ~~$= 15$~~ другий

$25 - x = 10$ км/год.

24)

Тишанчис - x г. 1 орлиб — 1

y орлиб

$\frac{y}{x}$ ишчи 1 орлиб x г.

$\frac{\frac{y}{x} + 1}{x} = y - 5$

1 орнов — x штучек

y орнов

$x+1$ $(x+1)(y-5)$ 2 рет $(x+4)(y-15)$

$y-5$

$$\begin{cases}(x+1)(y-5)=xy\\(x+4)(y-15)=xy\end{cases}\Rightarrow$$

$$\Rightarrow\begin{cases}xy-5x+y-5-xy=0\\xy-xy-15x+4y-60=0\end{cases}$$

$$\begin{cases}y-5x-5=0\\4y-15x-60=0\end{cases}\Rightarrow\begin{cases}y=5x+5\\20x+20-15x=60\end{cases}$$

$5x=40$

$x=8$

$y=45$

$xy=8\cdot45=360$

27. 0,9 0,12

$22-(22\ 0,9)=\quad 22-19,8=2,2$

$2,2\ 0,12=$

46. $200 \cdot 0{,}2 = x \cdot 0{,}4$

$$x = \frac{200 \cdot 0{,}2}{0{,}4} = 100$$

Отв. 10 ш 1-го рода

2.12 Ор.

Задача 1

Пусть $\overline{xy}$ | $\begin{cases} \frac{10x+y}{x+y} = \frac{6+\frac{5}{x+y}}{} \\ \frac{10y+x}{x+y} = 4 \cdot \frac{3}{x+y} \end{cases}$ ⇒

$$\begin{cases} 10x + y = 6x + 6y + 5 \\ 10y + x = 4x + 4y + 3 \end{cases} \Rightarrow \begin{cases} 9x - 9y = 2x + 2y + 2 \\ 7x - 11y = 2 \end{cases}$$

$$10y + 11y - 44y - 28y = 21$$

$$70y + 2 + 11y = 8 + 44y + 28y + 21$$

$$10y + \frac{2+11y}{7} = \frac{8+4y}{7} + y + 3$$

$$x = \frac{2+11y}{7}$$

$$9y = 21 \quad y = 3 \Rightarrow x = \frac{2+33}{7} = 5$$

Ответ: 53

Пр. $\frac{53}{5+3} = \frac{53}{8} = 6\,(5в)$

$\frac{35}{8} = 4\ (3ост)$

2. Число $\overline{xy}$. $\begin{cases} \frac{10x+y}{x^2+y^2} = 2+\frac{6}{x^2+y^2} \\ \frac{10x+y}{2xy} = 2+\frac{6}{2xy} \end{cases} \Rightarrow$

$\Rightarrow \begin{cases} 10x+y = 2x^2+2y^2+6 \\ 10x+y = 4xy+6 \end{cases} \Rightarrow 2x^2-4xy+2y^2=0$

$2\left(\frac{x}{y}\right)^2 - 4\frac{x}{y} + 2 = 0$

$\left(\frac{x}{y}\right)^2 - 2\frac{x}{y} + 1 = 0$

$D = 4-4 = 0$

$\frac{x}{y} = \frac{2}{2} = 1 \Rightarrow x = y$

Тогда $x = y$, тогда

$10y + y = 2y^2 + 2y^2 + 6$

$4y^2 - 11y + 6 = 0$

$D = 121 - 96 = 25$

$y_{1;2} = \frac{11 \pm 5}{8}$ — $\frac{3}{4}$ (не подх.), 2

Тогда $y = 2$, тогда $x = y = 2$

Ответ: 22.

Проверка: $\frac{22}{2 \cdot 2^2} = \frac{22}{8} = 2\ (6ост)$.

$\frac{22}{222} = 2\ (68)$

$y = 4 \Rightarrow x = 3$

Ответ: $3; 4$.

6.

4. $\begin{cases} \frac{10x+y}{x+y} = 4 + \frac{6}{x+y} \\ \frac{10x+y}{xy} = 3 + \frac{11}{xy} \end{cases} \Rightarrow \begin{cases} 10x+y = 4x+4y+6 \\ 10x+y = 3xy+11 \end{cases} \Rightarrow$

$\Rightarrow \begin{cases} 3x - 6y = 6 \\ 10x + y - 3xy = 11 \end{cases} \Rightarrow \begin{cases} x = 2y + 2 \\ 20y + 20 + y - 6y^2 - 6y = 11 \end{cases}$ 7

$6y^2 - 15y - 9 = 0$

$2y^2 - 5y - 3 = 0$

3. $\overline{xy}$

$\begin{cases} \frac{10x+y}{x+y} = 4 + \frac{6}{x+y} \\ \frac{10x+y}{x+y} = 4x + 4y + 6 \end{cases} \Rightarrow \begin{cases} 10x+y = 4x+4y+6 \\ 10x+y = 2x+2y+20 \end{cases} \Rightarrow$

$\Rightarrow \begin{cases} 10x+y - 2x - 2y = 20 \end{cases}$ 6.

$\Rightarrow 2x + 2y - 14 = 0$

$x + y - 7 = 0$

$x = 7 - y \Rightarrow 70 - 10y + y - 14 + 2y - 2y = 20$

$49y = 36$

$b = 25 + 24 = 49$

$y_{1;2} = \frac{5 \pm 7}{4} < -95$ (2 хиш.)

$3 \Rightarrow x = 8$

Тиш: 83.

5. $1\overline{xy}1$) 23 ширхэгээр хуваагдана

$\overline{xy}$

$$\frac{1000 + 100x + 10y + 1}{10x + y} = 23$$

$$1001 = 230x + 23y - 100x - 10y$$

$$130x + 13y = 1001$$

$$10x + y = 77$$

Тиш: 77.

6. $7\overline{xy} - \overline{xy}7 = 351$

$$700 + 10x + y - 100x - 10y - 7 = 351$$

$$90x + 9y = 342$$

$$10x + y = 38$$

Тиш: 38

7. $A = \overline{xy}$

$B = \overline{zt}$

$$\begin{cases} \frac{1000x + 100y + 10z + t}{10z + t} = 121 \\ \frac{1000z + 100t + 10x + y}{10x + y} = 84\frac{14}{10x + y} \end{cases} \Rightarrow$$

$$4\text{٢}0x + 1\text{٢}4y - 200z - 20t - 14 = 0$$

$$4\text{٢}(10x + 4y) - 20(10z + t) = 1\text{٩}$$

$$10x + 4y = \frac{14 + 20(10z + t)}{1\text{٢}}$$

$$100(10x + 4y) + 102 + t - 12102 - 12\text{٦}t = 0$$

$$1400 + 200002 + 2000t - 20\text{٧}002 - 20\text{٧}07 = 0$$

$$1400 - \text{٧}002 - \text{٧}07 = 0$$

$$102 + t = 35 \text{ (بالقسمة)} \qquad 10x + 4y = \frac{14 + \text{٩}80}{1\text{٢}} = \frac{7\text{٨}\text{٧}}{17} = \text{٧}2\text{٨}\text{٨}$$

$$14 + \text{٢}\text{٢}$$

$$\Rightarrow \begin{cases} 10000x + 100y + 102 + t = 12102 + 12\text{٦}t \\ 10002 + 1007 + 10x + 4y = 80x + 84y + 14 \end{cases}$$

$$\Rightarrow \begin{cases} 10000x - 80x + 100y - 84y + 102 + 10002 - 12102 - 12\text{٦}t + t = 0 \\ +1007 + 10x + 4y - 14 = 0 \end{cases}$$

$$4\text{٢}0x + 15y$$

$$\Rightarrow 10000x + 100y + 102 + t - 12102 - 12\text{٦}t + 10002 + 1007 +$$

$$+ 10x + y + 80x - 84y - 14 = 0$$

11 вариант. $\begin{cases} (10x+y) \text{ бр. а-ны} \\ (10z+t) \text{ в бр. в-ны} \end{cases}$

$$\begin{cases} \dfrac{100(10x+y)+10z+t}{10z+t} = 121 \\ \dfrac{100(10z+t)+10x+y}{10x+y} = 84\dfrac{14}{10x+y} \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} \dfrac{100a+b}{b} = 121 \\ \dfrac{100b+a}{a} = \dfrac{84a+14}{a} \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} 100a - 120b = 0 \quad (1) \\ 100b - 83a - 14 = 0 \end{cases} \Rightarrow 100a - 120b + 100b - 83a - 14 = 0$$

$$17a - 20b = 14$$

$a = \dfrac{14+20b}{17}$ (2) - с учетом (1) - ии

$$1400 + 2000b - 2040b = 0$$

$$40b = 1400.$$

$$b = 35 \Rightarrow a = \frac{14+20\cdot 35}{17} = 42$$

Ответ: A=35 B=35

B=42 A=42

10. $\overline{5xyz} - 3032 = 9 \cdot \overline{xyz}$

$5000 + 100x + 10y + z - 3032 = 900x + 90y + 9z$

$8\ (100x + 10y + z) = 1968$

$100x + 10y + z = 2y6$

Тиш: $\overline{xyz} = 2y6$

11. $\frac{\overline{1xyz7k1}}{\overline{1xyz7k}} = 3$

$(1000000x + 100000y + 10000z + 1000z + 10 = 3)$
$(100000x + 10000y + 1000z + 100z + 10k + 1 = 0)$

12. $\overline{7xyz} - 6857 = 2 \cdot \overline{xyz}$

$7000 + 100x + 10y + z - 6857 = 200x + 20y + 2z$

$100x + 10y + z = 143$

Тиш. $7143 - 6857 = 2 \cdot 143$

$286 = 286$ Тиш: 143.

Шагы арыз: $\frac{35y2}{\cancel{4}2} \cdot \frac{y235}{35} = 72y$

$\frac{35y2}{85y2} \cdot 8y(14x)$

11. $\frac{\overline{xyzlk1}}{1\overline{xyzlk}} = 3$

$$\frac{100000x + 10000y + 1000z + 100l + 10k + 1}{100000 + 10000x + 1000y + 100z + 10l + k} = 3$$

$$100000x + 10000y + 1000z + 100l + 10k + 1 - 300000 - 30000x -$$

$$- 3000y - 300z - 30l - 3k = 0$$

$$+ 70000x + 7000y + 700z + 70l + 7k = 299999$$

$$10000x + 1000y + 100z + 10l + k = 42859$$

Ответ: 142859.

12. $5\overline{xyz}5 - 73 = 156\overline{xyz}$

$$50000 + 1000x + 100y + 10z + 5 - 73 = 156000x + 15600y + 156z$$

$$14600x + 1460y + 146z = 49932$$

$$100x + 10y + z = 342$$

13. $\overline{7xyz} - \overline{xyz7} = 864$

$$7000 + 100x + 10y + z - 1000x - 100y - 10z - 7 = 864$$

$$900x + 90y + 9z = 6129$$

$$100x + 10y + z = 681$$

Ответ: 7681.

19	Верно:	x	$\frac{x-2}{x-2}=2$	$\frac{x-8}{y-8}=5$
	Ложь:	y	$y-2$	$y-8$

$$\begin{cases} x-2=2y-y \\ x-8=5y-40 \end{cases} \Rightarrow \begin{cases} x-2y=-2 \\ x-y=32-5y \end{cases} \Rightarrow \begin{cases} x=2y-2 \\ 2y-2y-32 \end{cases}$$

$$5y-2y=30$$

$$y=10 \Rightarrow$$

$$\Rightarrow x=18$$

Ответ: (18; 10)

20.	Найти	25 бит/мин	y	y	$xy=(25-x)(y-1)$
	Найдено		x	$y-1$	

7	Верно:	x	$\frac{x+5}{x+5}=\frac{\pi}{5}$	$\frac{x+1}{y+1}=2$
	Ложь:	y	$y+5$	$y+1$

5 минут - Аня

$$\begin{cases} \frac{x+5}{y+5}=\frac{\pi}{5} \\ \frac{x+1}{y+1}=2 \end{cases} \Rightarrow \begin{cases} 5x+25-\pi y-35=0 \\ x+1-2y+2=0 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} 5x-\pi y=10 \\ x-2y=-1 \end{cases} \Rightarrow \begin{cases} x=-1+2y \\ -5+10y-\pi y=10 \end{cases}$$

$$3y=15 \Rightarrow y=5; x=3$$

$xy = 30 \Rightarrow x = \frac{30}{y}$

$(25 - x)(y - 1) = 30$

$25y - 25 - xy + x = 30$

$25y - 25 - 30 + \frac{30}{y} = 30$

$25y^2 - 85y + 30 = 0$

$5y^2 - 17y + 6 = 0$

$D = 289 - 120 = 169 = 13^2$

$y_{1;2} = \frac{17 \pm 13}{10}$ / 0,4 (2 A) / 2 $\Rightarrow$

$\Rightarrow x = 15 \Rightarrow 25 - x = 10$

Отв: 10 км/ч и 15 км/ч.

21. 8 д. – ш. = 480 п.

I б.	x бр.	$\left(\frac{480}{x}\right)$ п.
II б.	(x − 20) бр.	$\frac{480}{(x-20)}$ п.

2 п. ш./бр.

$\frac{480}{x-20} - \frac{480}{x} = 2$

$\frac{480x - 480x + 9600}{x(x-20)} = 2$

$2x^2 - 40x - 9600 = 0$

$x^2 - 20x - 4800 = 0$

$\frac{D}{4} = 100 + 4800 = 70^2$

$x_{1;2} = \underline{10 \pm 70} = 80$ бр.

Отв: 80 бр.

22.

	60 км = 360 хв		
I т.	x т.	$\left(\frac{360}{x}\right)$ хв	7 хв швидше
II т.	$(x-42)$ т.	$\left(\frac{360}{x-42}\right)$ хв	

$$\frac{360}{x-42} - \frac{360}{x} = 7$$

$$\frac{360x - 360x + 15120}{x(x-42)} = 7$$

$$7x^2 - 294x - 15120 = 0$$

$$x^2 - 42x - 2160 = 0$$

$$\frac{D}{4} = 441 + 2160 = 2601 = 51^2$$

$$x_{1;2} = 21 \pm 51 = 72 \text{ км/год}$$

Відп: 72 км/год.

23.

	25 км – 120 хв		
1 т.	x т.	$\left(\frac{120}{x}\right)$ хв	5 хв швидше
2 т.	$(x-25)$ т.	$\left(\frac{120}{x-25}\right)$ хв	

$$\frac{120}{x-25} - \frac{120}{x} = 5$$

$$\frac{120x - 120x + 300}{x(x-25)} = 5$$

$$5x^2 - 125x - 300 = 0 \Rightarrow x^2 - 25x - 60 = 0$$

$b = 625 + 240 = 865$

24. (Ж — x орнов, y гвоздик)

1 орнов — x гвоздик

y орнов — xy гвоздик

$$\begin{cases} 2pb(x+1)\cdot(y-5) = xy \\ 2pb(x+4)(y-15) = xy \end{cases}$$

$$\begin{cases} xy - 5x + y - 5 = xy \\ xy - 15x + 4y - 60 = xy \end{cases} \Rightarrow \begin{cases} y = 5 + 5x \\ 20 + 20x - 15x = 60 \end{cases}$$

$5x = 40$

$x = 8 \Rightarrow y = 45$ орнов

$xy = 8 \cdot 45 = 360$ гвоздик

Ответ: 360 гвоздик

14. I раб. р — x | II раб. р — y | $x + y = 1224$ | $\frac{10x+3}{\frac{y-2}{10}}$ | $10x + 3 = \frac{y-2}{10}$

$$\begin{cases} x + y = 1224 \\ 10x + 3 = \frac{y-2}{10} \end{cases} \Rightarrow \begin{cases} x = 1224 - y \\ 12240 - 10y + 3 = \frac{y-2}{10} \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} x = 1224 - y \\ 122400 + 30 + 2 = y + 100y \end{cases} \Rightarrow \begin{cases} x = 1224 - y \\ y = \frac{124432}{101} = 1232 \end{cases} \Rightarrow$$

$$\begin{cases} y = 1232 \\ x = 12 \end{cases}$$

Ответ: $x = 12$; $y = 1232$

15. Пусть скорость х км/ч

$10x + 9 + 2x = 633$

$12x = 624$

$x = 52$

Ответ: $x = 52$.

16. $\frac{10x+5}{3x} = 3 + \frac{202}{3x}$

$10x + 5 = 9x + 202$

$x = 197$

Пр. $\frac{1975}{3 \cdot 197} = \frac{1975}{591} = 3\frac{202}{591}$

Ответ: $x = 197$.

17. $\frac{10x+5}{x+3} = x - 13$

$10x + 5 = x^2 - 10x - 39$

$x^2 - 20x - 44 = 0$

$\frac{b}{4} = 100 + 44 = 12^2$

$x_{1;2} = 10 \pm 12 = 22$

Ответ: 22.

Шунда: $\frac{225}{25} = 9$

Жауабы: $x = 32$

30. 15 – а жыл

x% - ну қосқан

$a - \frac{ax}{100} = a\left(1 - \frac{x}{100}\right)$

8a

29 V 45/d

b% - ну

8V = 3

33. X - шұрмағ/к ұ/іаа - 5000 грнб

ашуғ/шұрғ/іг у% - ну (2 шағым)

Ашуғ/шұ 7200 грнб

$\left(5000 + \frac{5000y}{100} + \frac{5000y^2}{100^2} = 7200\right)$

$5000 + 5000 + 50y + \frac{5000y + 50y^2}{100} = 7200$

$5000 + 50y + 5000y + 50y^2 = 7200$

$10000 + 100y + 100y + y^2 = 144$

$y^2 + 200y + 98560 = 0$

$b = 40000 -$

40. Задача на %. x прибыль

$x + x \cdot 0{,}2 = 1{,}2x$

$1{,}2x - 0{,}24x = 0{,}96x$

$\frac{0{,}96x}{x} = 0{,}96$ новый

$\frac{x}{0{,}96x} = \frac{1}{0{,}96} = \frac{100}{96} = \frac{25}{24}$

52.

	первый	x рабочих	z прибыль
I	100 рабочих	$100-x$ рабочих	t прибыль
II			

$x + y = 1$

$$\begin{cases} xz = 100t - xt \\ (100-x)z = 1800 \\ xt = 800 \end{cases}$$

$t = \frac{800}{x}$

$z = \frac{1800}{100-x}$

$\frac{1800x}{100-x} = \frac{100 \cdot 800}{x} - \frac{800x}{x}$

$1800x^2 = (100-x)(80000 - 800x)$

$1800x^2 = 8000000 - 80000t - 8000x +$

53. $\bar{I}$ -с - х эр.

$(X-3)$ эр.

X эр - 3000 грнб

$(X-3)$ эр - 1800 грнб

$\frac{3000}{X}$ гр $\frac{1800}{X-3}$ гр.

$\frac{3000(x-3)}{X} - \frac{1800x}{X-3} = 150.$

$\frac{3000x-9000}{X} - \frac{1800x}{x-3} = 150.$

Ктшуфь шгтшчгшгф. 10р 1-30.

1. 9 тчг - 2% 2 гчкшр шгш 12% 4.12.05р.

? 2Чгфшъ б 1003,2 4ф ш 3чгк

2. Ывргфгфшъ фгабшгс - а а-?

тгчгшчг - р

$\begin{cases} a\left(1+\frac{q}{100}\right)^2 = 12100 \\ a\left(1+\frac{q}{100}\right)^3 = 13310 \end{cases}$ =>

$$1 + \frac{q}{100} = 1{,}1$$

$$q = 10 \Rightarrow \quad a = \frac{12100}{\left(1 + \frac{q}{100}\right)^2} = 10000 \text{ грн}$$

Відп: 10000 грн.

3. $p = 10\%$

Зрівняти вартість a гривень

a - ?

$$a\left(1 + \frac{q}{100}\right)^2 = 48400.$$

$$a = \frac{48400}{1{,}21} = 40000$$

Відп: 40000 гривень

4. Вартість обуд. будинку - a

Після знецінення 25, відсоток $p\%$ від вартості будинку складе $(a + a \cdot 0{,}35)$ грн

p - ?

$$a + a \cdot 0{,}25 + \frac{(a + 0{,}25a)}{100} p = a + 0{,}35a$$

$$125a + (a + 0{,}25a)\, 1{,}25a\, p = 135a$$

$$p = \frac{135a - 125a}{1{,}25a} = \frac{10a}{1{,}25a} = 8\%$$

Відп: 8%

5. Ученик был а лет

Через 16 лет, отдыхая Р% от

ученик был должен а - 0,37а

$$(a - 0{,}16a)\left(1 + \frac{P}{100}\right) = a - 0{,}37a$$

$$0{,}84a\left(1 - \frac{P}{100}\right) = 0{,}63a$$

$$1 - \frac{P}{100} = \frac{0{,}63a}{0{,}84a}$$

$$P = (1 - 0{,}75)\,100 = 25\%$$

Ответ: 25% от.

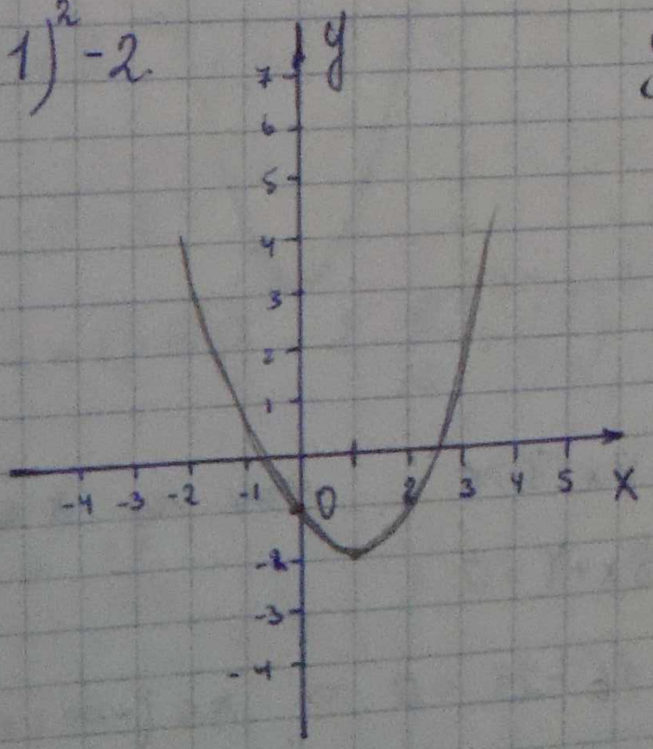
6.

10.12.04г.

Урок 201

а)

$$y = x^2 - 2x - 1 = (x-1)^2 - 2$$



$$y = (x-1)^2 - 2$$

$x = 0 \quad y = -1$

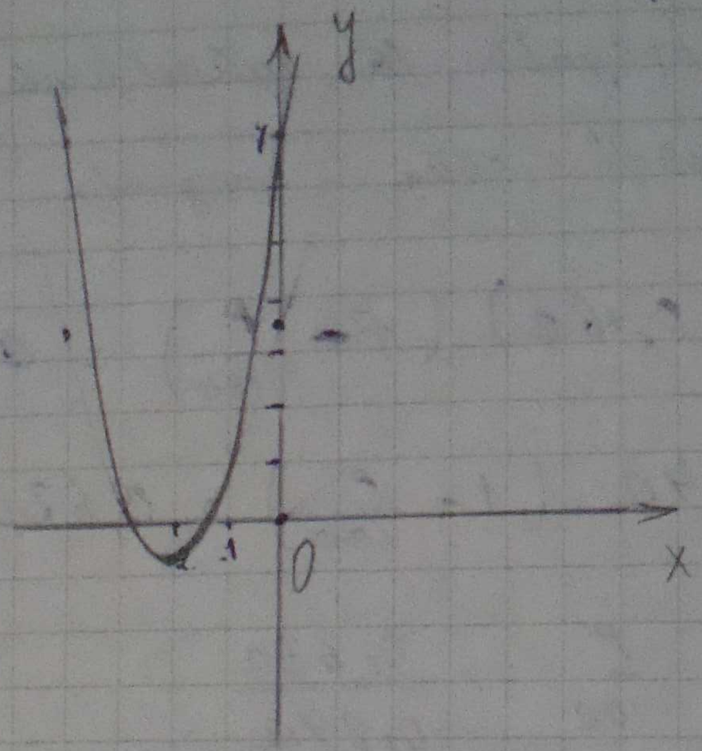
при $y = 0$

$$(x-1)^2 = 2$$

$$x - 1 = \sqrt{2}$$

$$x = \sqrt{2} + 1$$

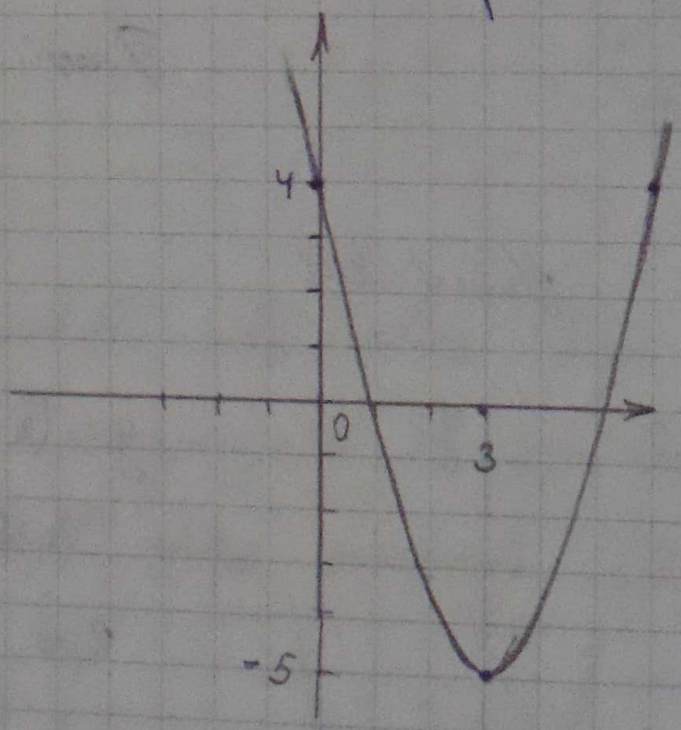
г) $y = 2x^2 - 8x + 7 = x^2 - 4x + 3{,}5 + 0{,}5 - 0{,}5 = 2(x-2)^2 - 0{,}5$



Орб $x = 0$

$y = 3{,}5$ ~~3,5~~ 7

д) $-x^2 + 6x - 4 = x^2 - 6x + 4 = (x-3)^2 - 5$



Орб $x = 0$

$y = 4$

203. а) $3x^2 - 8x + 7 > 0$ Ищ. пр $x \in R$ шынд-а болат

$3x^2 - 8x + 7 = 0$

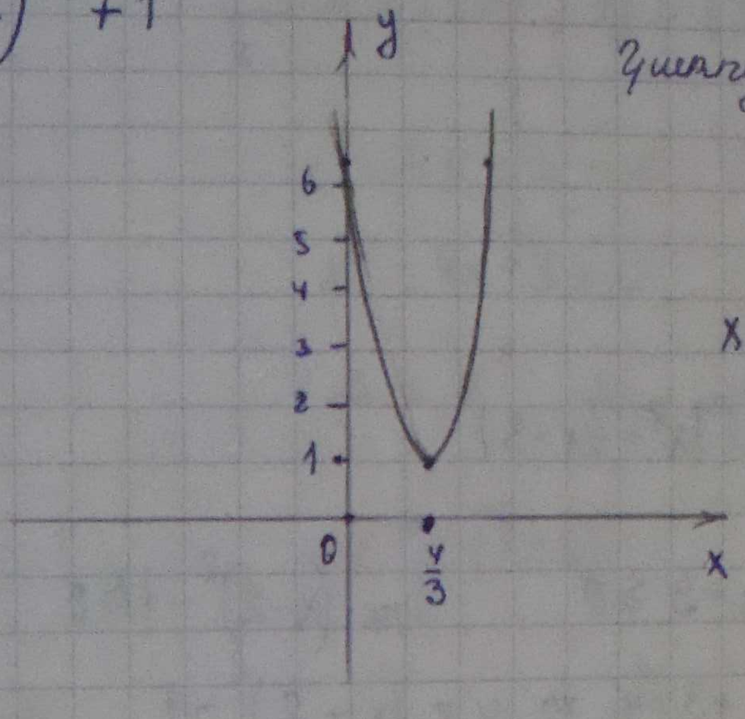
$\frac{D}{4} = 16 - 21 < 0 \Rightarrow x \in (-\infty; +\infty)$

$3x^2 - 8x + 7 > 0$

$3\left(x^2 - \frac{8}{3}x + \frac{7}{3}\right) = 3\left(x^2 - 2\cdot\frac{8}{6} + \left(\frac{7}{3} - 1\right)^2 + 1\right) = + \left(\frac{8}{6}\right)^2 / \cdot 7$

$= 3\left(x^2 - 2\cdot\frac{8}{6}x + \left(\frac{8}{6}\right)^2 + \left(\frac{8}{6}\right)^2 + \frac{7}{3}\right) =$

$= 3\left(x - \frac{8}{6}\right)^2 + 1$



Ղարդում ենք $y = 3\left(x - \frac{4}{3}\right)^2 + 1$ -ի գրաֆիկը

$x = 0 \quad y = \frac{19}{3}$

Գտնենք $y = 0$

$\left(x - \frac{4}{3}\right)^2 = -\frac{1}{3}$

$x \in \emptyset \Rightarrow$

Ա) պարզում ենք գրաֆիկի Ox-ի հետ հատումները

Եվրա $\Rightarrow \quad x \in R \quad y > 0$:

Ա) $-5x^2 + 9x - 5 < 0$

$5\left(x^2 - \frac{9}{5}x + 1\right) = 05\left(x^2 - 2\cdot\frac{9}{10} + \left(\frac{9}{10}\right)^2 - \left(\frac{9}{10}\right)^2 + 1\right) =$

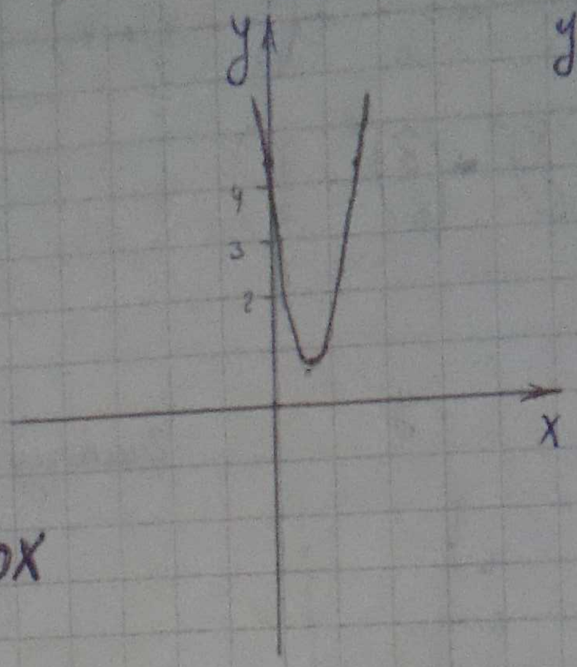
$= \left(x - \frac{9}{10}\right)^2 + \frac{19}{100}$

$y = 5\left(x - \frac{9}{10}\right)^2 + \frac{19}{100}$

$x = 0$

$y = \frac{81}{20} + \frac{19}{100} = \frac{405+19}{100} =$

$= \frac{424}{100} = \frac{106}{25} = 4\frac{6}{25}$

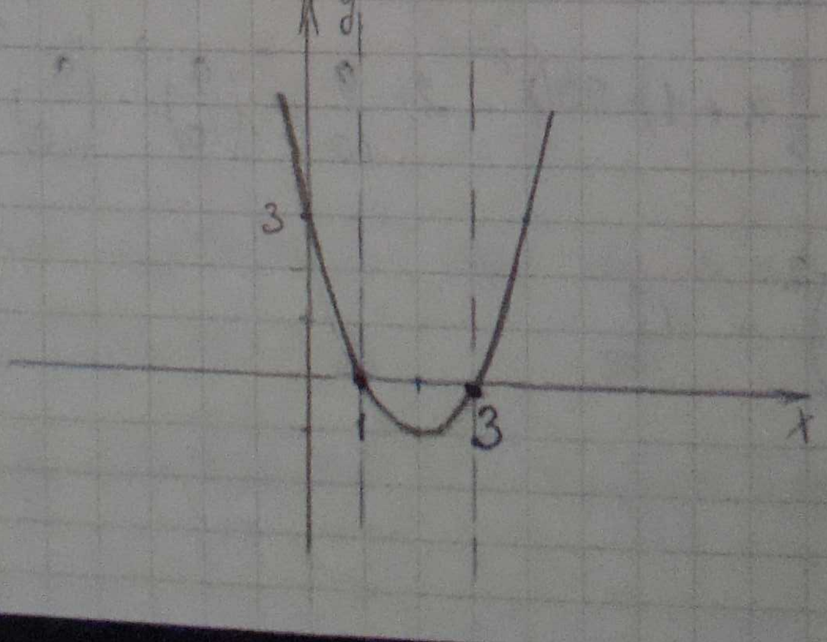


q - ~~sh~~ ox

205. $y = |x^2 - 4x + 3|$

$\begin{cases} x^2 - 4x + 3 \geq 0 \\ x^2 - 4x + 3 = y \end{cases} \Rightarrow y = (x-2)^2 - 1$

$\begin{cases} x^2 - 4x + 3 < 0 \\ x^2 - 4x + 3 = -y \end{cases} \Rightarrow (x-2)^2 - 1 = -y$



$y = (x-2)^2 - 1$

$x = 0 \; ; \; y = 3$

$x^2 - 4x + 3 \geq 0$

$x^2 - 4x + 3 = 0$

$D = 16 - 12 = 2^2$

$x_{1;2} = \frac{4 \pm 2}{2} \begin{cases} 1 \\ 3 \end{cases}$

$x \in (-\infty; 1] \cup [3; +\infty)$

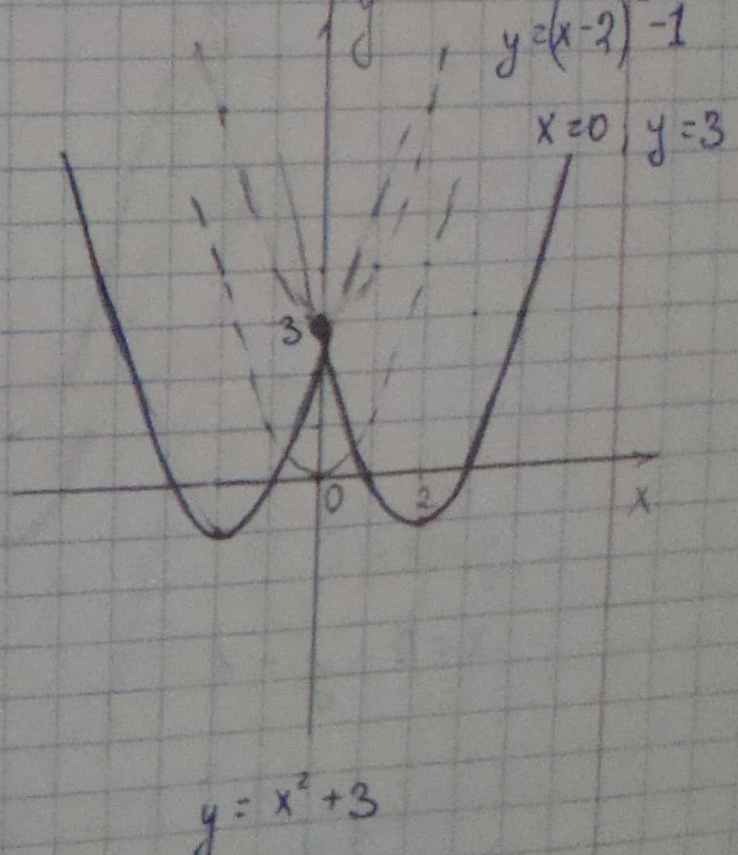
$y = (x-2)^2 - 1$

$x^2 - 4x + 3 < 0$

$x^2 - 4x + 3 = 0$

$D = 2^2 \quad x_{1;2} \begin{cases} 1 \\ 3 \end{cases}$

$x \in (1; 3)$



f) $y = x^2 - 4|x| + 3$

$$\begin{cases} (x \geq 0) \; x > 0 \\ y = x^2 - 4x + 3 \Rightarrow y = (x-2)^2 - 1 \end{cases}$$

$$\begin{cases} x = 0 \\ y = x^2 + 3 \end{cases}$$

$$\begin{cases} x < 0 \\ y = x^2 + 4x + 3 = (x+2)^2 - 1 \end{cases}$$

$y = x^2 + 3$

x	y
0	0
-2	4

$y=(x+2)^2-1$

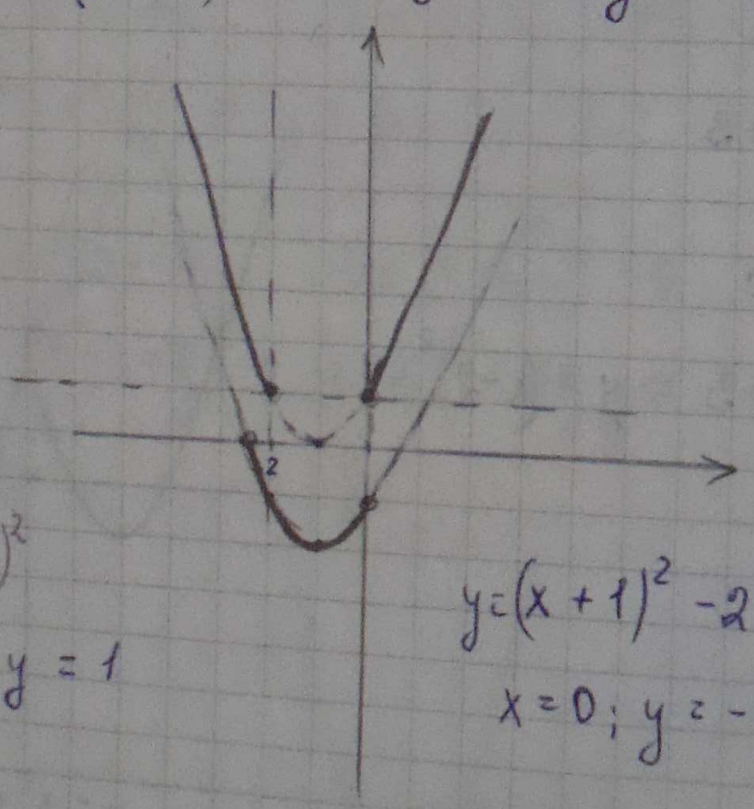
$x<0$

4) $y=|x^2+2x|+1$

$\begin{cases} x^2+2x>0 \Rightarrow x(x+2)>0 \Rightarrow x\in(-\infty;-2)\cup(0;+\infty) \\ y=x^2+2x+1 \Rightarrow (x+1)^2=y \end{cases}$

$\begin{cases} x^2+2x=0 \Rightarrow x=0;\ x=-2 \\ y=1 \end{cases}$

$\begin{cases} x^2+2x<0 \Rightarrow x\in(-2;0) \\ y=-(x^2+2x)+1 \Rightarrow y=x^2+2y-1=(x+1)^2-2 \end{cases}$



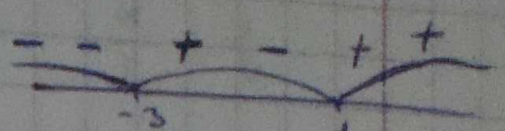
$y=(x+1)^2$

$x=0;\ y=1$

$y=(x+1)^2-2$

$x=0;\ y=-1$

7) $y = \frac{|x+3|}{|x-1|}$ (р-ие f)



$x+3=0 \quad x-1=0$

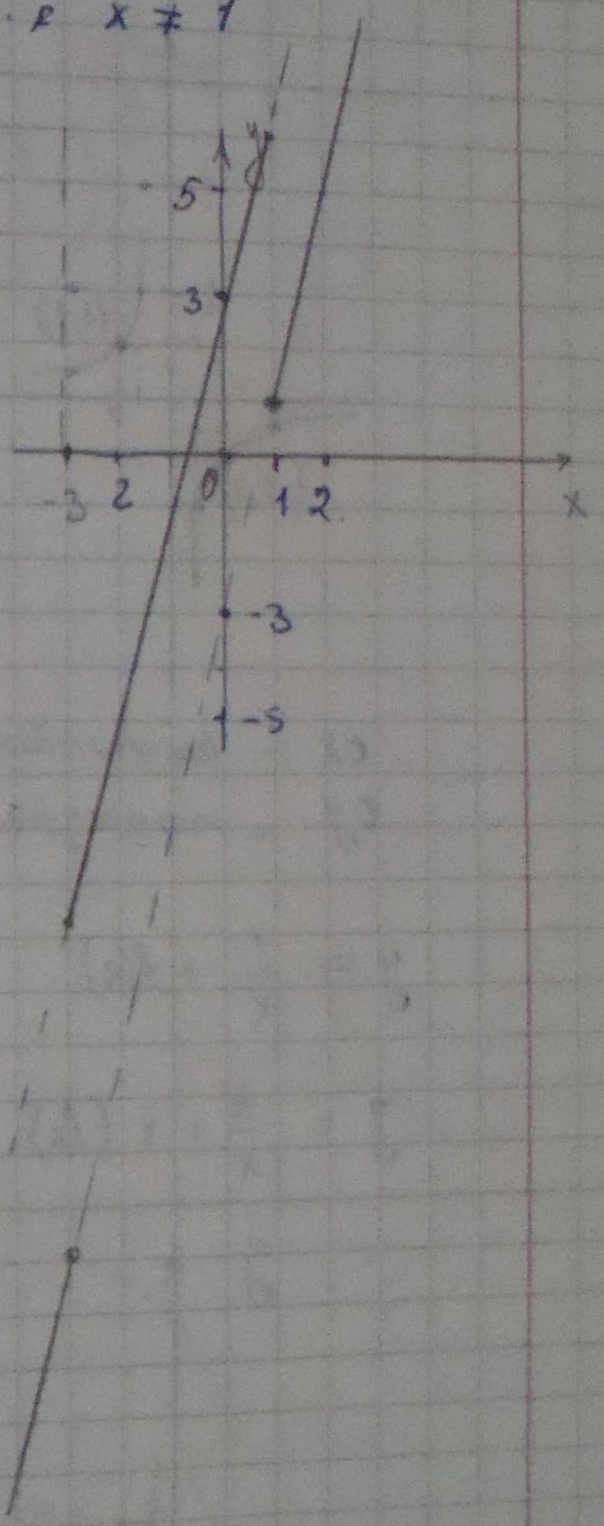
$x=-3; x=1$

$\begin{cases} x < -3 \\ y = \frac{-(x+3)}{-(x-1)} \end{cases} \Rightarrow x \in (-\infty; -3) \quad y = \frac{x+3}{x-1}$

р-ие $x \neq 1$

$\begin{cases} -3 \leq x \leq 1 \\ y = \frac{x+3}{1-x} \end{cases} \Rightarrow x \in [-3; 1]$

$\begin{cases} x > 1 \\ y = \frac{x+3}{x-1} \end{cases} \Rightarrow x \in (1; +\infty)$



$y = \frac{x+3}{x-1}$

$x=0 \quad y=-3$

$2 \qquad 5$

$y = \frac{x+3}{1-x}$

$x=0 \quad y=3$

$x=2 \quad y=5$

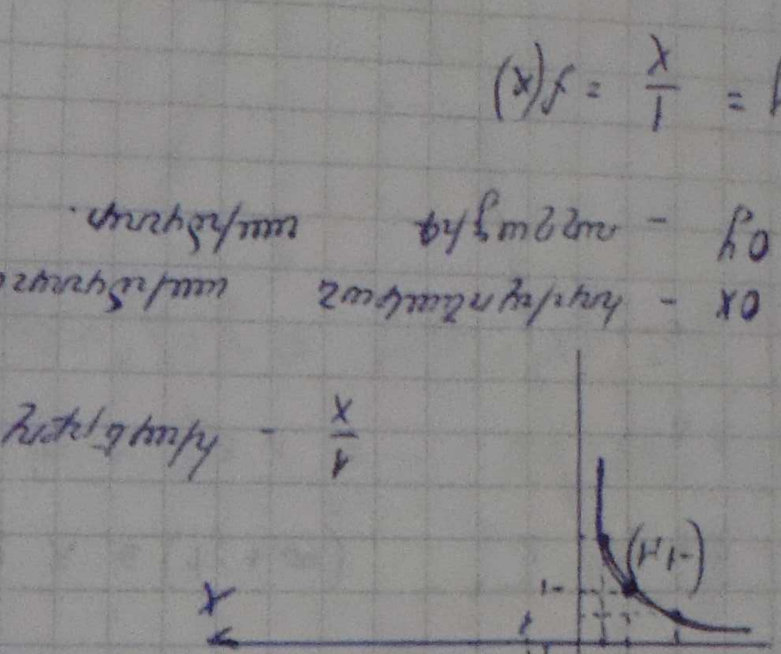
$y = \frac{k}{x}$ — график $k = 1$ $y = \frac{1}{x}$

x	y
1	1
2	$\frac{1}{2}$
3	$\frac{1}{3}$
-1	-1
-2	$-\frac{1}{2}$
-3	$-\frac{1}{3}$

$D(f) = R / \xi 0 \}$

$E(y) = R / \xi 0 \}$

$y = \frac{x}{2}$

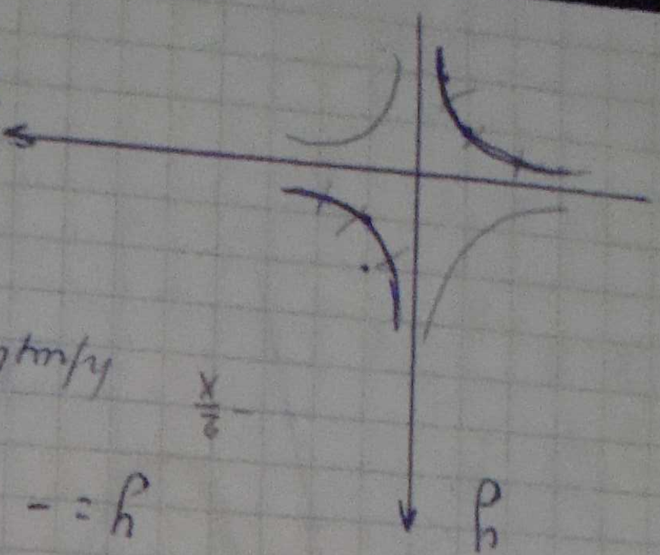


OX – ҳақиқий сонлар ўқи

OY – мавҳум сонлар ўқи.

$y = \frac{1}{x} = f(x)$

$y = \frac{k}{x} = k f(x)$



$y = -\frac{1}{x}$ (ҳиперболанинг

$-\frac{2}{x}$ ҳиперболик, $k = 1$)

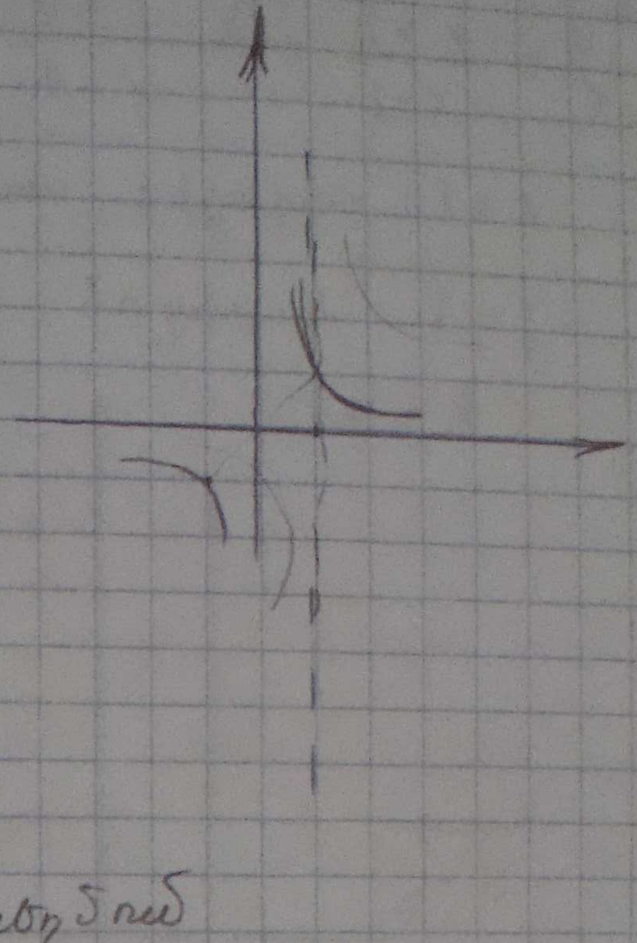
нуқталар ўрнини

шартларга биноан

$y = f(x) + 1 \; (x+1)$

$f(x) = \frac{1}{x}$

$f(x+a) = \frac{1}{x+a}$



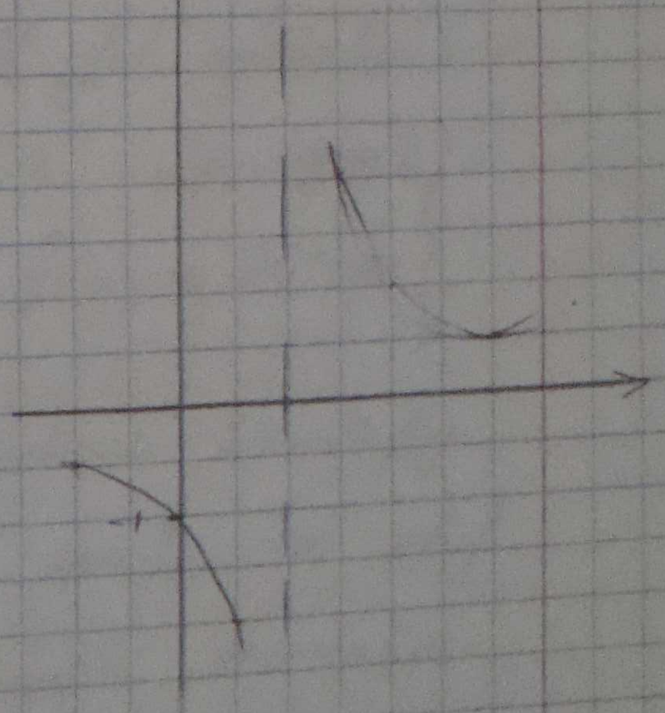
$f(x) = \frac{1}{x-1}$

$x = 0 \quad y = -1$

$\mathcal{L}\, f(x)$ - здесь шаг шаблон

$y = \frac{1}{x-1} = f(x)$

$y = \frac{1}{x-1} + 1 = f(x) + 1$



$\mathcal{L}\, f(x) = R / \{1\}$

$E\, f(x) = R / \{1\}$

$\frac{1 + x - 1}{x - 1} = \frac{x}{x-1}$

Упрощение дроби для функции и производной

$y = \frac{ax + b}{cx + d}$

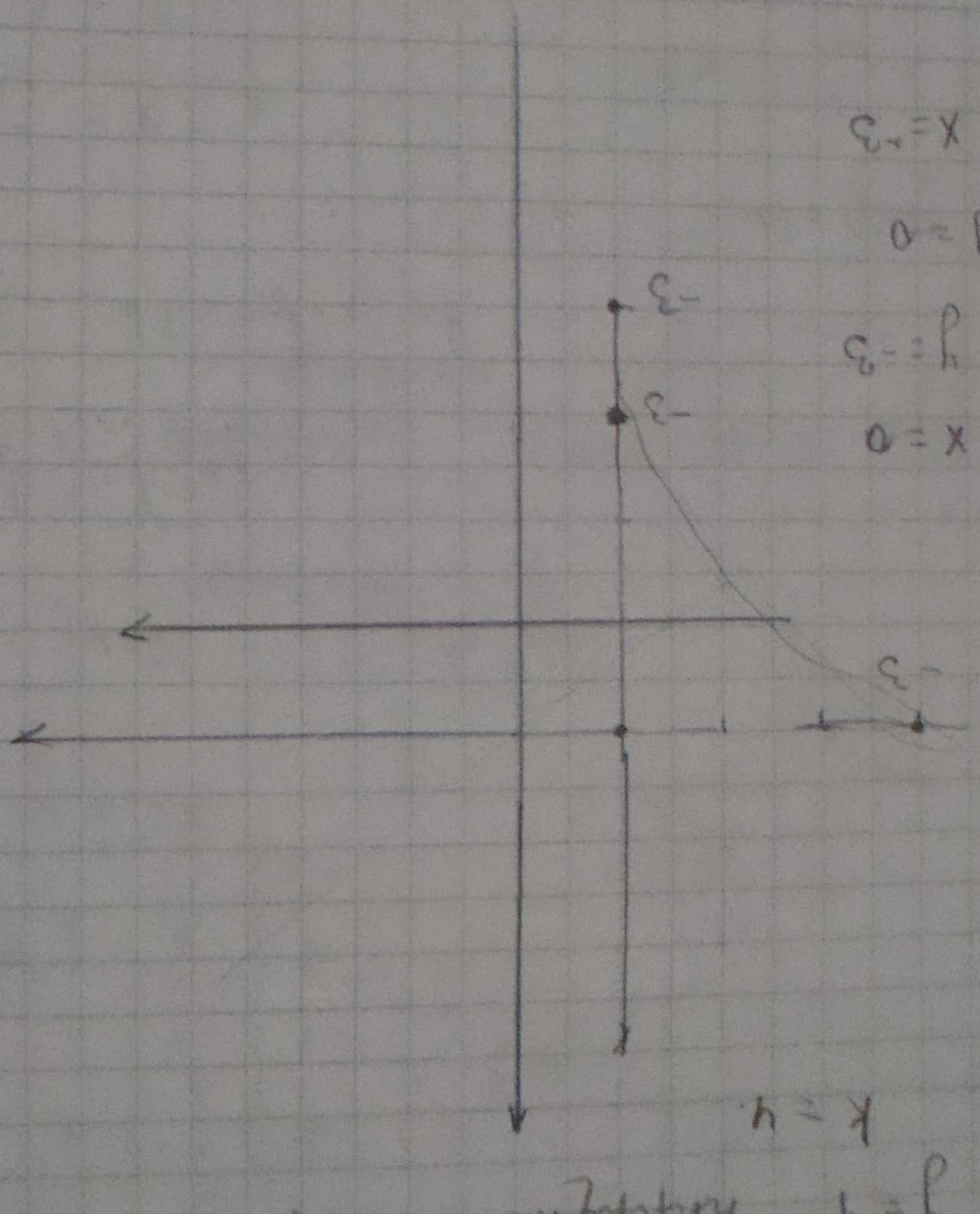
$x = -\frac{d}{c}$ - шаблон

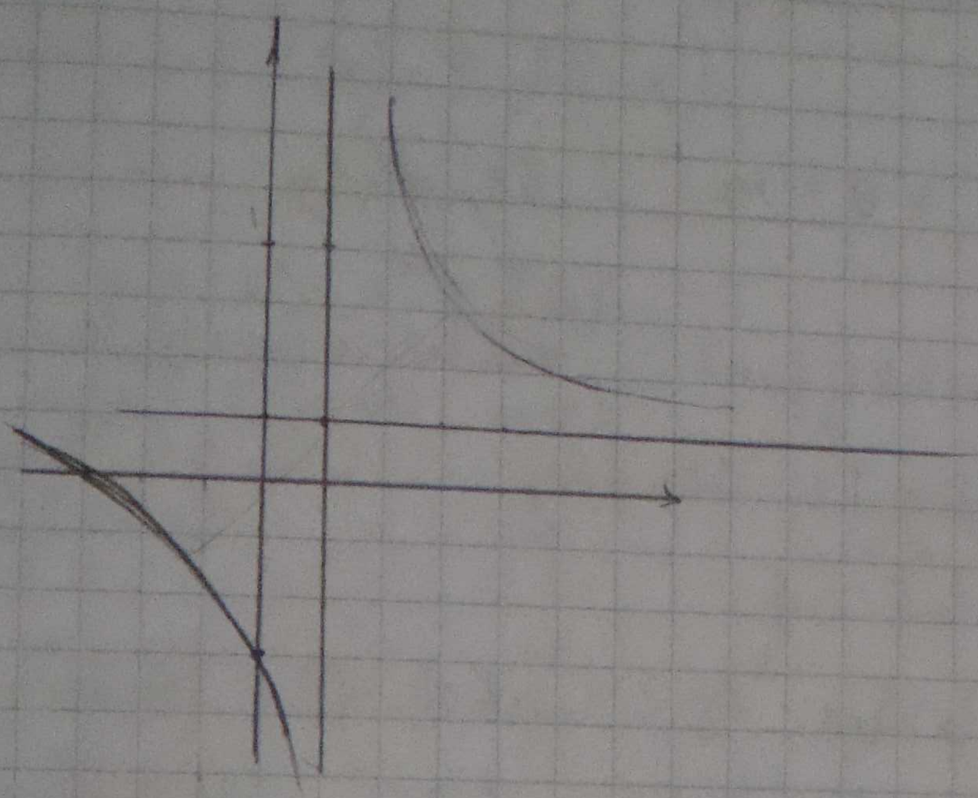
$$y = \frac{x+3}{x-1} = \frac{x-1+4}{x-1} = \frac{4}{x-1} + 1$$

→ mm systému $x = 1$

→ mm asymptoty $y = 1$

$x = y$





Սահմանափակություն

Սահմանական

$y = f(x)$ ֆունկցիան կոչվում է սահմանափակ
վերևից, եթե գոյություն ունի M թիվ այնպես, որ
$(x \in D(f))$ բոլոր արժեքների դեպքում
բոլոր x -երի համար $f(x) \le M$

$y = f(x)$ կոչվում է սահմանափակ ներքևից,
եթե գոյություն ունի m թիվ այնպես, որ
բոլոր x -երի համար $f(x) \ge m$.

Օր $y = 5 - x^2$ $x \in R$

$x \in R$ $5 - x^2 \le 5 = M$ սահմանափակ վերևից

$y = |x-1|$

$x \in R$

$|x-1| = 0 \Rightarrow$ extremum

$E(f) = [1; \infty)$

$\max f(x)$ не существует

$E(f) = [-25; 0)$

$\min f(x) = -25$

$\max f(x) \cdot$ не существует

$\sin x \in [-1; 1]$

Функция ограничена и достигает своих наиб. и наим. значений

$f(x) = c$ пр. δ шаблон. и наиб. огр. сверху

$\exists M > 0 \; \forall x \; -M \le f(x) \le M$

наим. выполнен M

$E(f)$

Функция ограничена снизу, достигает наименьшего значения

$\forall x \in D(f) \Rightarrow -x \in D(f)$

$f(x) = f(-x)$

Өр: $y = 5 - x^2 = f(x)$

$D(f) = (-\infty; +\infty)$

$f(-x)$

$f(-x) = 5 - (-x)^2 = 5 - x^2 = f(x)$ тэнц тул функц

парын

тэгэхээр $f(x)$ - нь тэнц үү $\Rightarrow$

Γ_f нимүүрний ОУ тэр - н тэй.

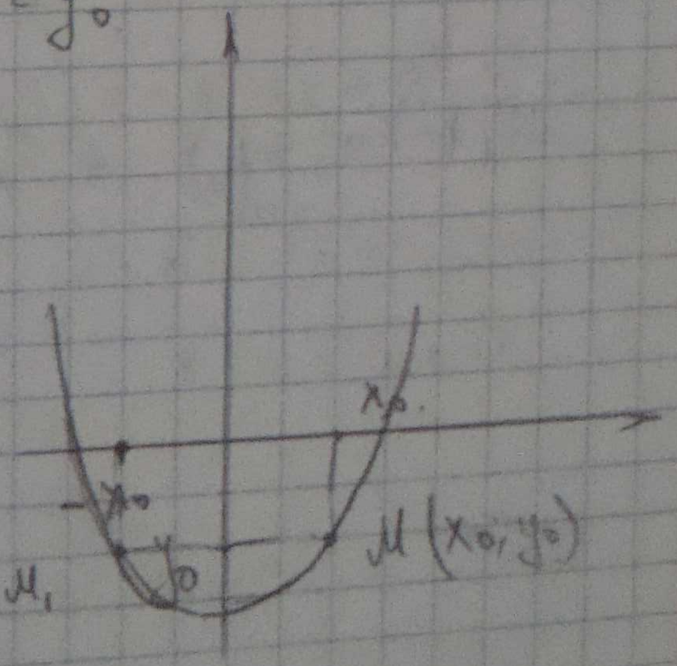
Нот. Ямар нэгэн $(x_0; y_0) \in \Gamma_f$

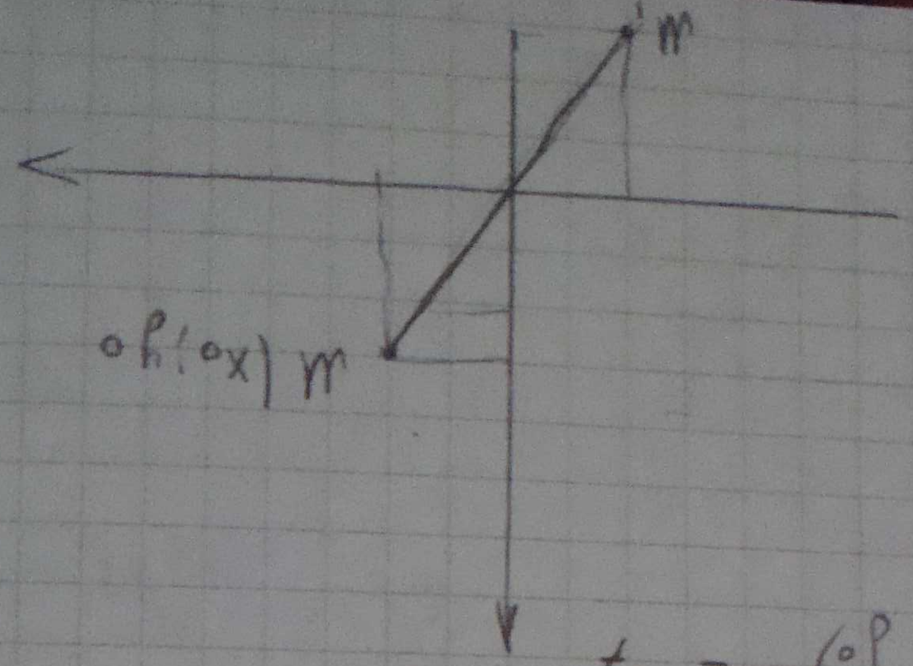
$y_0 = f(x_0)$

$f(-x_0) = f(x_0) = y_0$

$y_0 = f(-x_0)$

$(-x_0; y_0) \in \Gamma_f$





$M_1(-x_0; -y_0) \in \Gamma_f$

$f(x_0) = -f(x_0)$

$y_0 = f(x_0)$

$M(x_0; y_0) \in \Gamma_f$ — симметрична

Чётная. Нечётная ни чётная ни нечётная

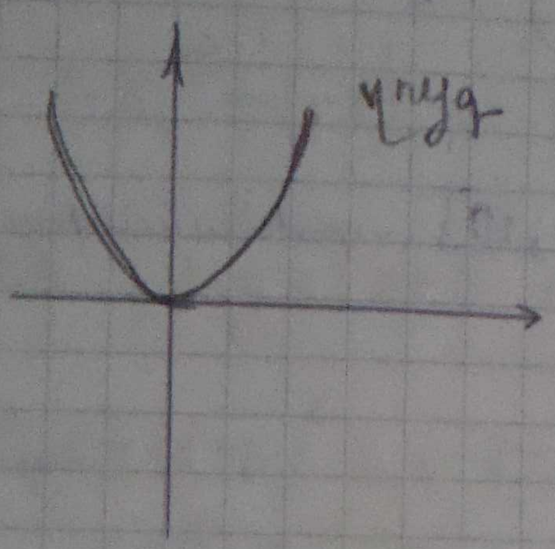
$y = f(x)$ - нечётная, если $\forall x \in D(y) \Rightarrow -x \in D(f)$

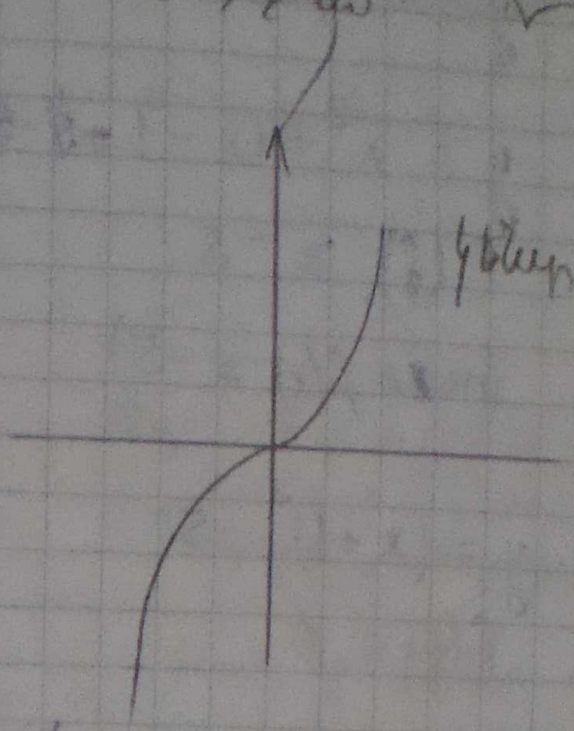
$f(-x) = -f(x)$

а) $y = \frac{x^2+1}{x^3}$ $\quad f(-x) = \frac{(-x)^2+1}{(-x)^3} = \frac{x^2+1}{-x^3} =$

$= -\frac{x^2+1}{x^3} = -f(x)$

Значит нечётная, ни чётная ни нечётная





Прим. § 5, 76 №2

Задачи 209 - 213, 217, 218, 229, 230, 236, 237, 238

11 12.05 р. а) $y = x^2 + 7x + 8 = (x + 3,5)^2 - 4,25$

y $x \in D(f)$ $E(f) \geq -4,25$

$E(f) \in [-4,25; +\infty)$

$\min f(x) = 4,25$

б) $y = 6x - x^2 - 5 = -(x^2 - 6x + 5) = -(x^2 - 6x + 3^2 - 3^2 + 5) =$

$= (x - 3)^2 - 4$

$E(f) \in [-4; +\infty)$

$\min f(x) = -4$

9) $y = x^2 + 4x - 1 \qquad x \in [-6; 10]$

$y = x^2 + 4x - 1 + 5 - 5 = (x+2)^2 - 5$

$E(f) \geq -5$

$(\min f(x) = -5) \qquad E(f) \in [-5; 10]$ – наибольшая

? н) $y = (x+1)^3 - 5$

$E(f) \in \emptyset$

210. м) $y = \frac{1}{x-1}$

229. ш) $f(x) = x^2 + 1$ чтн. пр $f(-x) = f(x)$

$(-x)^2 + 1 = x^2 + 1$

?

ф) $f(x) = \cos 2x$

ч) $f(x) = |x| + x^4$ чтн, пр ууу 9 §. 5

чтн. $|-x| + (-x)^4 = |x| + x^4$

$|-x| + (-x)^4 = x + x^4$

$|x| + x^4 = x + x^4$

230. а) $f(x) = x^5 - x$ чет. пр. нечет.

чет. $f(-x) = -f(x)$

$(-x)^5 + (-x) = -(x^5 - x)$

237. а) $y = (x+1)^2 + (x-1)^2$ чет. $x \in D(f) \Rightarrow -x \in D(f)$

Покажем, что четн., нечет. или ни четн. ни нечет.

(чет.) $(1-x)^2 + (-x-1)^2 =$

$= (x^2 - 2x + 1) + (x + 2x + 1) =$

$= (x-1)^2 + (x+1)^2$

$(x-1)^2 + (x+1)^2 \neq -((x-1)^2 + (x+1)^2)$

в) $y = x^5 - 2x^2 + 1$ $x^2 = y\ t$ ни чет ни нечет ?

$y = \underline{\underline{t^3 - 1}} = (t-1)(t^2 + t + 1)$

$y(-t^3-1) = y(-t-1)(t^2+t+1) = -(t+1)(t^2 - t + 1) \neq -(t^3+1)$ ни чет

$t^3 - 1 \neq -t^3 - 1$ чет. б.

$t^3 - 1 \neq t^3 + 1$ нечет. з.

պարբերականություն

$T \neq 0$ իրական է $f(x)$ ֆունկցիայի պարբերություն եթե $\forall x \in D(f)$ $x \pm T \in D(f)$ և $f(x+T) = f(x)$

Պարբերական է $y = \{x\}$ ֆունկ. նաև քանի x-ի ամբողջ նաև իրական է $x - \in$ հավասարության ամենամեծ ամբողջ բիվ/ը $[x]$ –

Օր. $[5] = 5$, $[3,7] = 3$ (ամբողջ նաև) $[0] = 0$, $[-5,6] = -6$

x-ի իռացիոնալության նաև. իրական է $x - [x] = \{x\}$

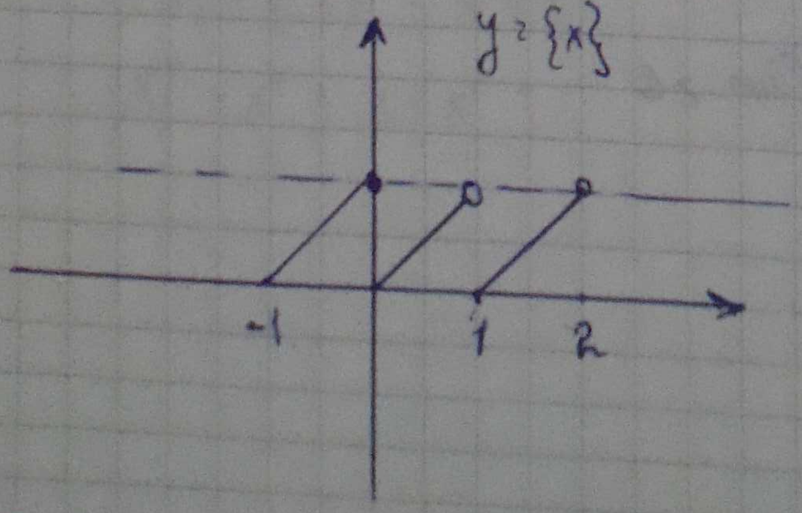
x-ը կամ հանված որևէ ամբողջ նաև

$x - [x] = \{x\} \in [0; 1)$

որե որևէ x բիվ/ի դրական n բիվ

$n \in \mathbb{Z}$, $\{x + n\} = \{x\}$ . . . . .

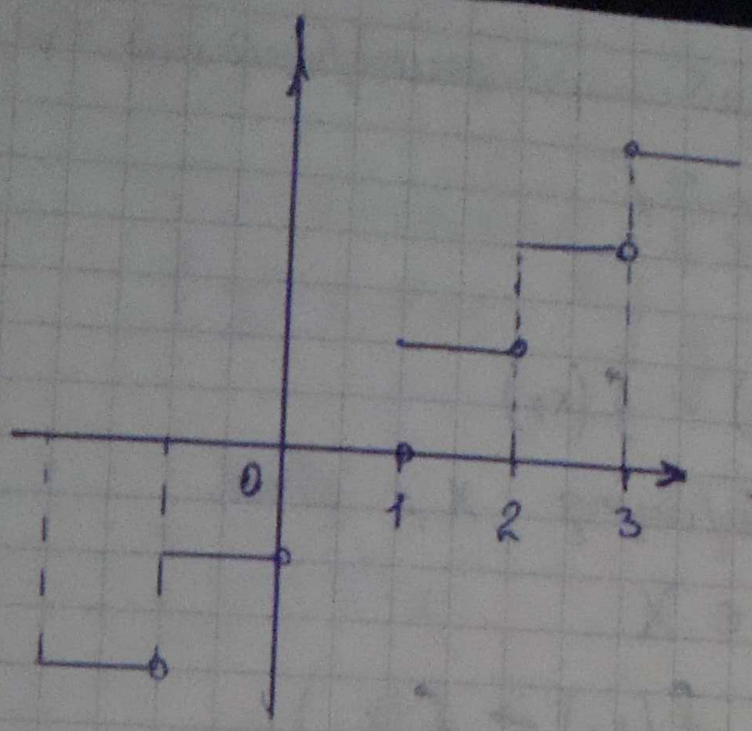
Պարբ. գտնել/հայտ գրաֆիկ.



$y = \{x\}$

$x \in [0;1)$

$y = x$



Եթե $f(x)$ պարբ b

T պարբ. b ⇒

⇒ $n \cdot T$ նույնպես պարբերական է

Եթե $T \neq 0$ $x + T \in D(f)$

$$f(x+T) = f(x)$$

$$f(x+2T) = f(\underbrace{x+T}_{x_1}+T) = f(x+T) = f(x)$$

Եթե ֆունկց. պարբ է T պարբերությամբ.

$(a ; a+T)$ - գրաֆիկը չի կտրվում

Թեորեմ՝

$f(x)$ ֆունկցիան կոչվում է աճող x փոփոխականի նկատմամբ միջակայքում, եթե այդ միջակայքում պարբերական երկու արժեքների

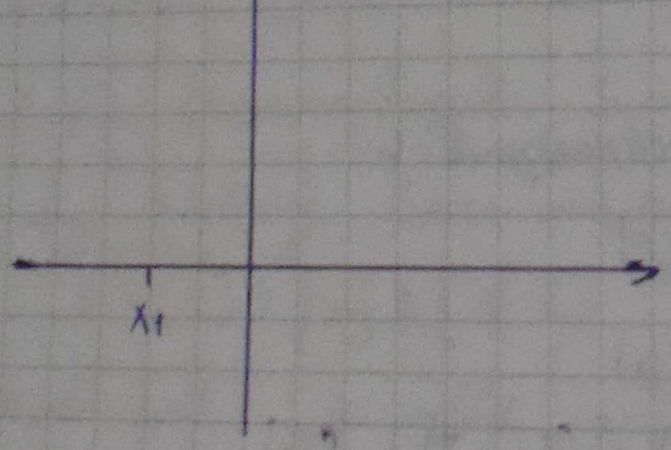
Теорема об f(x) наибольшее значение
Возрастает обозначается

$\forall x_1; x_2 \in X$

$x_1 < x_2 \Rightarrow f(x_1) < f(x_2)$

f(x-ая) функция называется строго $\forall x_1; x_2 \in X$

$x_1 < x_2 \Rightarrow f(x_1) \geq f(x_2)$



Пример

$-\infty \leq x_1 > x_2 \leq 0$

$(-x_1) > -x_2 \geq 0$

$(-x_1)^2 > (-x_2)^2$

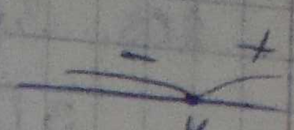
$x_1^2 > x_2^2$

$f(x_1) > f(x_2)$

Можно и теорему доказать по-другому

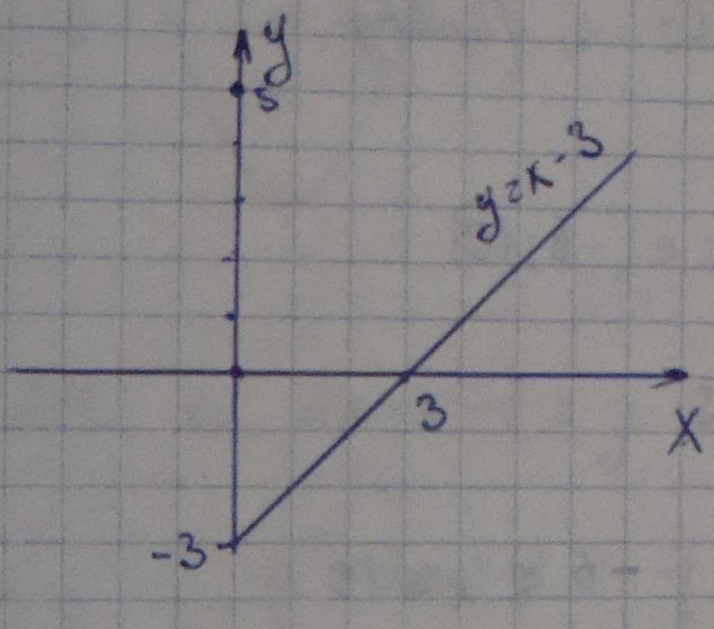
198 г) $y = |x-4| + 1$

$x - 4 = 0 \quad x = 4$

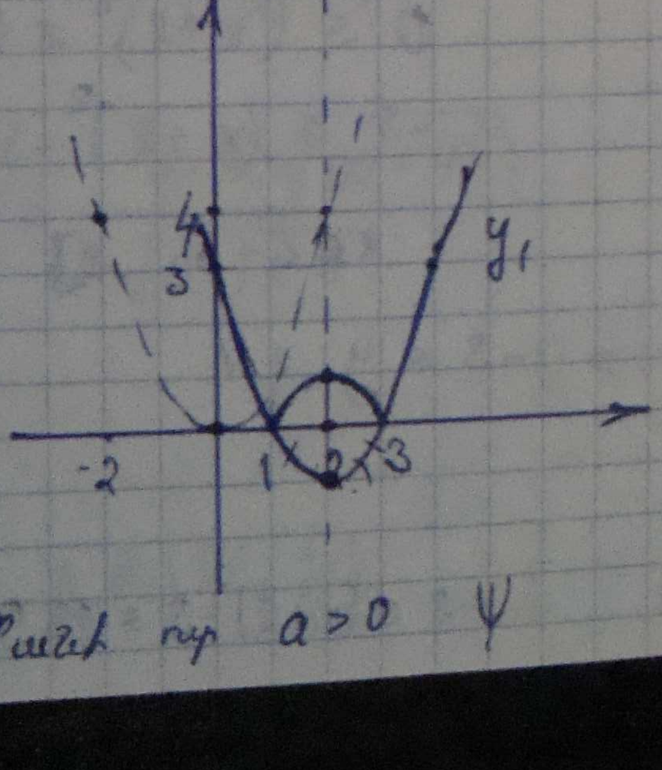


$$\begin{cases} x - 4 \geq 0 \; x \geq 0 \\ y = x - 4 + 1 \end{cases} \Rightarrow \begin{cases} x \geq 0 \\ y = x - 3 \end{cases}$$

$$\begin{cases} x < 0 \\ y = 5 - x \end{cases}$$



205. $y = |x^2 - 4x + 3| = |(x-2)^2 - 1|$



$y = x^2$

x	y
0	0
1	1
-1	1
-2	4

$y = (x-2)^2 - 1$ Орв $y = 0$

$x = 0 \quad y = 4 - 1 = 3$ $x_1 = 3$

$x_2 = 1$

Гилк пр $a > 0$ ψ

208. $3x^2 - 8x + 7 > 0 \qquad x \in R$

$$3\left(x^2 - \frac{8}{3}x + \frac{7}{3}\right) = 3\left(x - \frac{4}{3}\right)^2 + \frac{5}{3} > 0$$

209. а) $y = 6x - x^2 - 5 =$

$6x - x^2 - 5 = -(x^2 - 6x + 5) = -((x-3)^2 + 4)$

$-(x-3)^2 + 4$

$-(x-3)^2 + 4 \leq 4$. $\Rightarrow M$ число в (вершину:

б) $y = x^2 + 4x - 1 \qquad x \in [-6; 10]$

$x^2 + 4x - 1 = (x+2)^2 - 5$

$(x+2)^2 \geq 0$

$(x+2)^2 - 5 \geq -5$

$x \in [-5; 10]$.

$-6 \leq x \leq 10$

$-4 \leq x + 2 \leq 12$

$-4 \leq x + 2 \leq 0$.

$0 \leq (x+2)^2 \leq 16$

$-5 \leq (x+2)^2 - 5 \leq 11$

$x \in [-6; -2]$

$-5 \leq y \leq 11$

$x \in [-2; 10$

$0 \leq x + 2 \leq 12$

$0 \leq (x+2)^2 \leq 144$

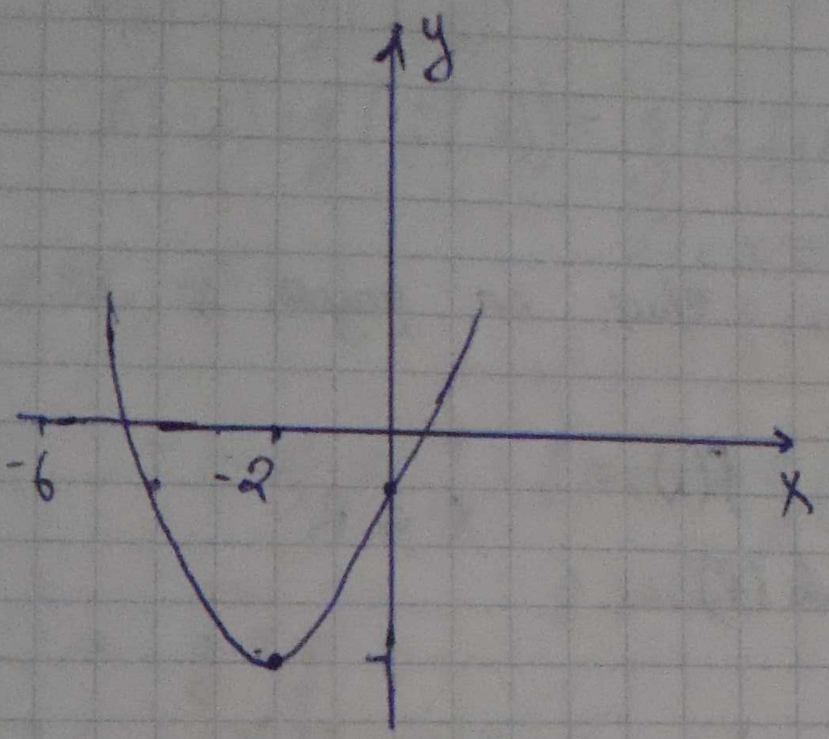
$-5 \leq (x+2)^2 - 5 \leq 139$

$-5 \le y \le 139$

$x \in [-6; 10]$

-5

$-5 \le y \le 139$



$x_{12} =$

211. а) $2x - x^2 - 1 = y$

$-(x^2 - 2x + 1) = -(x-1)^2$

б) $y = \frac{1}{\sqrt{|x|+4}} \cdot + \frac{1}{2}$ $\quad x \in R.$

$|x| + 4 \ge 4$

$\sqrt{|x|+4} \ge 2$

$\left(y = \frac{2 + \sqrt{|x|+4}}{2\sqrt{|x|+4}}\right)$

$0 < \frac{1}{\sqrt{|x|+4}} \le \frac{1}{2}$

$y \in (0; \frac{1}{2}]$ $\quad \frac{1}{2} < \frac{1}{\sqrt{|x|+4}} + \frac{1}{2} \le 1$

$E(f) = \left(\frac{1}{2}; 1\right]$

$\max f(x) = 1$

$\min f(x)$ - q.z

229. a) $f(x) = x \sin \frac{x}{2}$ chuq. ap yny q ~

$f(-x) = f(x)$ $\quad f(x) = \quad x \in R$

$x \in D(f) \quad -x \in D(f)$

$f(-x) = -x \sin \frac{(-x)}{2} = x \sin \frac{x}{2} = f(x)$

230. $f(x) = x^5 - x$.

chuq. $f(x) = -(f(x))$

$f(x) = -(x^5 - x) = -x^5 + x = -(x^5 - x)$

231. b $f \circ g$ $\quad f$ - c yny q, g - ь ylbip

$f \circ g = F(x)$

$F(x) = f(g(x))$

$F(-x) = f(g(-x)) = f(-g(x)) = f(g(x)) = F(x)$

$g \circ f$

$g \circ f = F(x)$

$F(x) = g(f(x))$

$F(-x) = g(f(-x)) = g(-f(x)) = g(f(x)) = F(x)$

235. $F(x) =$

$F(-x) = g(f(-x)) = g(-f(x)) = g(f(x))$

$\alpha \; g \circ g =$

$F(-x) = g(g(x)) = g(g(-x)) = g(-g(x)) = -g(g(x))$

$= -F(x)$

233. $F(x) = \frac{f(x) + f(-x)}{2} =$

$F(-x) = \frac{f(-x) + f(x)}{2}$

$F(x) = \frac{f(x) + f(-x)}{2} =$

$= \frac{f(-x) + f(x)}{2} = F(-x)$

в) $F(-x) = \frac{f(x) - f(-x)}{2}$

$F(-x) = \frac{-(f(x) - f(+x))}{2} = \frac{-f(x) - f(x)}{2}$

234. а) $y = \frac{x^2+1}{x^2+x+1} =$

$= f(x) = \frac{f(x)+f(-x)}{2} + \frac{f(x)-f(-x)}{2} =$

$= \frac{\frac{x^2+1}{x^2+x+1} + \frac{x^2+1}{x^2-x+1}}{2} + \frac{\frac{x^2+1}{x^2+x+1} - \frac{x^2+1}{x^2-x+1}}{2} =$

$= \frac{(x^2+1)(x^2-x+1)+(x^2+1)(x^2+x+1)}{(x^2+x+1)(x^2-x+1)} =$

$= \frac{(x^2+1)(2x^2+2)}{(x+1)^2(x-1)^2} = \frac{2(x^2+1)^2}{(x+1)^2(x-1)^2}$

$y = 3x^2 - 5x + 7 = (3x^2+7) + (-5x)$

238. (а) $\frac{x^3-x}{x^4+x^2+1}$

ш) $y = \frac{1}{1+x+x^2} - \frac{1}{1-x+x^2}$ =

172-ly.

$$F(x) = \frac{1}{x^2+x+1} - \frac{1}{x^2-x+1} \qquad x \in R$$

$$F(-x) = \frac{1}{(x+1)^2} - \frac{1}{(x-1)^2} = -\left(\frac{1}{(x+1)^2} + \frac{1}{(x-1)^2}\right)$$

=

173/

$$f(x) = \frac{3x-5}{x^2-1}$$

ъ (f) $x^2 - 1 = 0$

$x \neq \pm 1$

ъ f(ъ $f \in (-\infty; 1) \cup (-1; +1) \cup (1; +\infty)$

г) $f(-2) ; f(0,5) ; (3)$

$f(-2) = -\frac{11}{3}$

$f(0,5) = \frac{-3,5}{-0,75} = \frac{14}{3}$

$f(3) = \frac{4}{8} = 0,5$

$-7; 0; 2,5 \in E(f)$

$\times 48$
$\frac{7}{336}$ 5

$$\frac{3x-5}{x^2-1} = -7$$

$$3x-5 = -7x^2+7$$

$$7x^2+3x-12=0$$

$$D = 9+336 = 345$$

(nu mai) $D>0$

$$3x-5 \neq 0$$

$$\begin{cases} x = \frac{5}{3} \\ x^2 \neq \pm 1 \end{cases}$$

176.

a) $y = \frac{2+x}{x+1}$

$D(f) \in (-\infty; -1) \cup (-1; +\infty)$

$x+1 \neq 0$

$x \neq -1$

$$\frac{2+x}{x+1} = a$$

$a = ?$ (nu mai) $D>0$

$2+x = ax+a$

$a(x$ $x(a-1) = 2-a$

$$x = \frac{2-a}{a-1}$$

$a \neq 1$

176.

4. $y = \sqrt{50 - 2x^2}$

$50 - 2x^2 \neq 0$

$x^2 \neq 25$

$x \neq \pm 5$

$D(f) \in (-\infty; -5) \cup (5; +\infty)$

$D(f) \in (-5) \cup [5; +\infty)$

$E(f) = (x^2 \leq 25 \cdot)$ $x^2 - 25 \leq 0$

$(x-5)(x+5) \leq 0$

$D(f) \in [-5; 5]$.

$E(f)$

$\sqrt{50 - 2x^2} = a$

$a \geq 0$

$50 - 2x^2 = a^2$

$X = a \quad x \in \sqrt{\frac{50 - a^2}{2}} \geq 0$

$E(f) = R$

$\frac{50 - a^2}{2} \geq 0$

$50 - a^2 \geq 0$

$a^2 \leq 50$

$a \leq \pm 5\sqrt{2}$

$E(f) \in [-5\sqrt{2}; 5\sqrt{2}]$

$a \geq 0$

$E(f) \in [0; 5\sqrt{2}]$

$a \in [-5\sqrt{2}; +5\sqrt{2}]$

177. 2.

$$y = \frac{\sqrt{x^2-4x-12}}{\sqrt{8-x}} ; \quad y = \sqrt{\frac{x^2-4x-12}{8-x}}$$

$$\frac{x^2-4x-12}{8-x} \geq 0 \qquad x \neq 8$$

$$\left[\begin{array}{l} \begin{cases} x^2-4x-12 \geq 0 \\ 8-x > 0 \end{cases} \Rightarrow \begin{cases} x \in (-\infty; -2] \cup [6; +\infty) \\ x \in (-\infty; 8) \end{cases} \Rightarrow x \in (-\infty; -2] \cup [6; 8) \\ \begin{cases} x^2-4x-12 < 0 \\ 8-x \leq 0 \end{cases} \Rightarrow \begin{cases} x \in (-2; 6) \\ x \in [8; +\infty) \end{cases} \Rightarrow x \in \varnothing \end{array}\right.$$

$$x^2-4x-12 = 0.$$

$$D = 16 + 4 + 12 = 4^2$$

$$x_{1;2} = \frac{2 \pm 4}{2} \begin{array}{l} -2 \\ 6 \end{array}$$

$$x^2-4x-12$$

$$\begin{cases} x^2-4x-12 \geq 0 \\ 8-x > 0 \end{cases} \Rightarrow \begin{cases} x \in (-\infty; -2] \cup [6; +\infty) \\ x \in (-\infty; 8) \end{cases}$$

$x^2 - 4x - 12 = (x-2)^2 - 16$.

$f(x) = \sqrt{36 - x^2} + 3x^3$

$36 - x^2 \geq 0$

$(6-x)(6+x) \geq 0$

$(x-6)(x+6) \leq 0$

$\alpha(f) \in [-6; 6]$

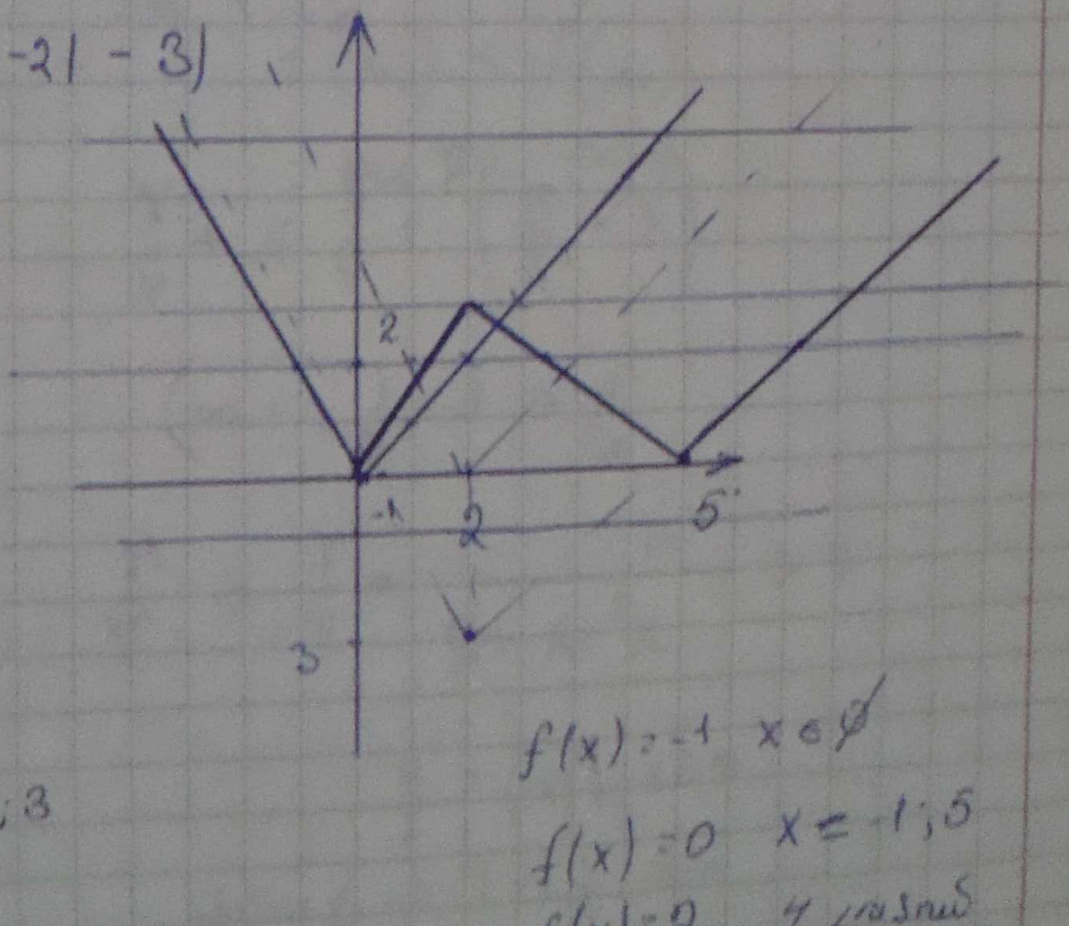
174 $f(1)$; $f(1,5)$, $f(2)$, $f(\sqrt{6})$

$$f(x) = \begin{cases} x-1, & x \in [0; 1,5] \\ -4x, & \text{где } x \in (1,5; 2] \\ x^2+2, & x \in (2; 3] \end{cases}$$

$f(1) =$

$f(x) = ||x-2| - 3|$

$x-2$



$a = -1, 0, 2, 3$

$f(x) = 5$ 2 решения

$f(x) = -1$ $x \in \varnothing$

$f(x) = 0$ $x = -1; 5$

$f(x) = 2$ 4 решения

$f(x) = 3$ 3 решения

212. ա) $y = x^3 + 3x$, $x \in [0; 3]$

$0 \le x \le 3$

$0 \le x^2 \le 27$ | умножим

$0 \le 3x \le 9$

$0 \le x^3 + 3x \le 36$

$\min f(x) = 0$

$\min f(x) = 36$

212. б) $y = \dfrac{1}{x^2 - 3x + 2}$

$x^2 - 3x + 2 = \left(x - 1{,}5\ \frac{3}{2}\right)^2 - \frac{9}{4} + 2 = \left(x - \frac{3}{2}\right)^2 + \frac{7}{4}$

$\left(x - \frac{3}{2}\right)^2 + \frac{7}{4} \ge + \frac{7}{4}$

$y \in \left[-\frac{1}{4}; +\infty\right)$

$a > b > 0$

$\frac{1}{a} < \frac{1}{b}$

$0 < \dfrac{1}{x^2 - x + 2} + \frac{7}{4} \le \frac{4}{7}$

$\max f(x) = \frac{4}{7}$

$\min f(x)$ ар ~~мах~~

212. a) $y = x^3 + 3x$, $x \in [0; 3]$

$0 \le x \le 3$

$0 \le x^2 \le 27$ (умножим на x)

$0 \le 3x \le 9$

$0 \le x^3 + 3x \le 36$

$\min f(x) = 0$

$\min f(x) = 36$

212. б) $y = \dfrac{1}{x^2 - 3x + 2}$

$x^2 - 3x + 2 = \left(x - 1{,}5\ \frac{1}{2}\right)^2 - \frac{9}{2} + 2 = \left(x - \frac{3}{2}\right)^2 + \frac{7}{2}$

$\left(x - \frac{3}{2}\right)^2 + \frac{7}{4} \ge +\frac{7}{4}$

$y \in \left[-\frac{1}{4}; +\infty\right)$

$0 < \dfrac{1}{x^2 - x + 2} + \frac{7}{4} \le \frac{4}{7}$

$\max f(x) = \frac{4}{7}$

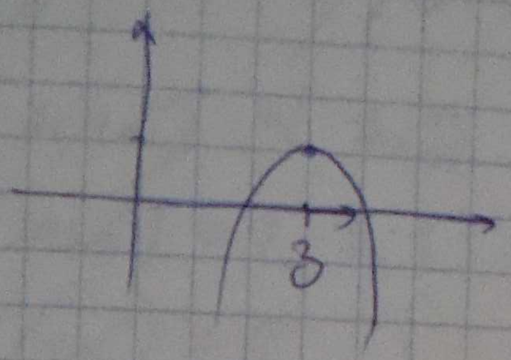
$\min f(x)$ ар қилмайди

$a > b > 0$

$\frac{1}{a} < \frac{1}{b}$

2461 $f(x) = -x^2 + 6x - 8$

$-(x^2 - 6x + 8) = -((x-3)^2 - 1) = 1 - (x-3)^2$



$(-\infty; 3) \cup (3; \infty)$

$x_1 < x_2 < 3$

$f(x_2) - f(x_1) = 1 - (x_2^2 - 3)^2 - (1 - (x_1^2 - 3)^2) = (x_1 - 3)^2 - (x_2 - 3)^2 =$

$= (x_1 - 3 - x_2 + 3)(x_1 - 3 + x_2 - 3) = (x_1 - x_2)(x_1 + x_2 - 6)$

$f(x_2) - f(x_1) > 0$

$x_1 - x_2 < 0 \quad x_1 + x_2 - 6 < 0$

$(-\infty; 3]$ ↑ возр

$3 \leq x_1 < x_2 < +\infty$

$f(x_2) - f(x_1) < 0 \qquad f(x_2) < f(x_1)$

$x \in [3; \infty)$ ↓

шаһ 5.

$\cos\alpha = x$

$\sin\alpha = y$

$tg\alpha = \frac{y}{x}$

$ctg\alpha = \frac{x}{y}$

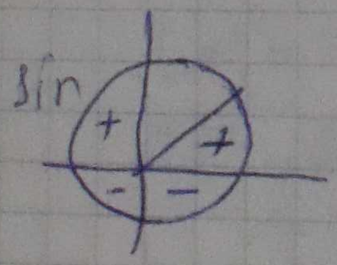
ибүлмәли α үчүн $\sec\alpha = \frac{1}{\cos\alpha}$

$\sec\alpha = \frac{1}{\cos\alpha}$

cosec (үчүлтә үчүн) $\alpha = \frac{1}{\sin\alpha}$.

Әлдә үчүлтәрә дәүр. һөкүмәтә.

Үчүн үзүлтәрә sin



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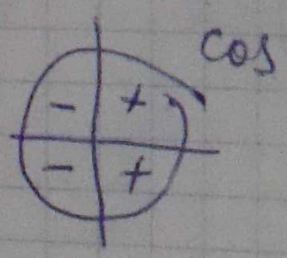
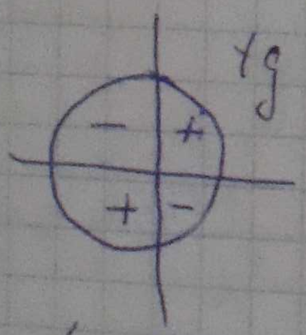




II һөкүмәт. Әлдә үчүлтәрә үчүлтә үчүлтә.

$b(\sin\alpha) = R$

$b(\cos\alpha) = R$.

$D(tg\alpha) = R \setminus \{\frac{\pi}{2} + \pi k,\ k \in Z\}$.

$D(ctg\alpha) = R \setminus \{\pi k,\ k \in Z\}$.

$E(\sin\alpha) = [-1; 1]$

$E(\cos\alpha) = [-1; 1]$

$E(tg\alpha) = R$

$E(ctg\alpha) = R$

Функция чётная, если

$f(-x) = f(x)$ график симметричен относительно оси Oy

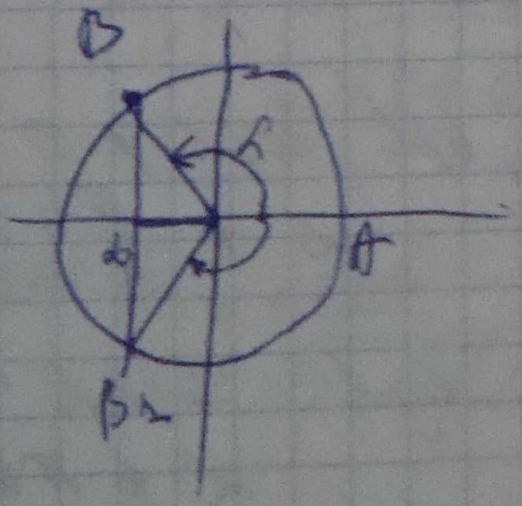
$f(-x) = -f(x)$ график симметричен относительно O

$\sin(-\alpha) = -\sin\alpha$ нечётная

$\cos(-\alpha) = \cos\alpha$ чётная

$tg(-\alpha) = -tg\alpha$

$ctg(-\alpha) = -ctg\alpha$



$\sin\alpha = BD$

$\sin(-\alpha) = -B_1D = -BD = -\sin\alpha$

$BA = B_1D =$

$\cos\alpha = \cos(-\alpha)$

$\cos(120^\circ) = \cos(-120^\circ)$

$\sin(-120^\circ) = -\sin(120^\circ)$

~~tgα~~

$\sin(\alpha + 36 \cdot 2\pi n) = \sin\alpha$

$\cos(\alpha + 2\pi n) = \cos\alpha$

$tg(\alpha + 2\pi n) = tg\alpha$

$ctg(\alpha + 2\pi n) = ctg\alpha$

~~sin~~

T вид α $y=f(x)$

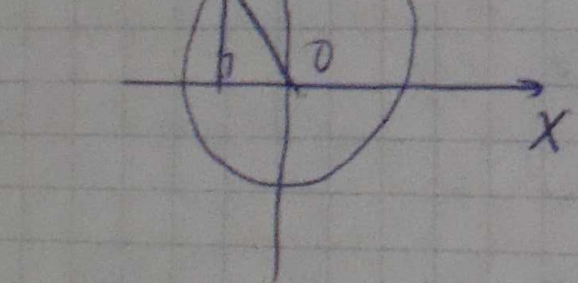
$T = 2\pi n$, $n \neq 0$

$n \in Z$

$T = 2\pi$

Основные тригонометрические тождества

1. $\sin^2\alpha + \cos^2\alpha = 1$ $\alpha \in R$



$\alpha \in R$ $\cos\alpha$

$\sin\alpha = \pm\sqrt{1-\cos^2\alpha}$

$\cos\alpha = \pm\sqrt{1-\sin^2\alpha}$

2) $tg\alpha = \frac{\sin\alpha}{\cos\alpha}$, tpt $\cos\alpha \neq 0$

$\alpha \neq \frac{\pi}{2} + \pi k$

3) $ctg\alpha = \frac{\cos\alpha}{\sin\alpha}$, tpt $\sin\alpha \neq 0$

$\alpha \neq \pi k$

4) $tg\alpha \cdot ctg\alpha = 1$ $\alpha \neq \frac{\pi}{2} k$

5) $1 + tg^2\alpha = \frac{1}{\cos^2\alpha}$

$1 + \frac{\sin^2\alpha}{\cos^2\alpha} = \frac{\cos^2\alpha + \sin^2\alpha}{\cos^2\alpha} = \frac{1}{\cos^2\alpha}$

$\cos\alpha = \pm \frac{1}{\sqrt{1 + tg^2\alpha}}$

$\sin\alpha = \frac{tg\alpha}{\pm\sqrt{1 + tg^2\alpha}}$

6) $1 + ctg^2\alpha = \frac{1}{\sin^2\alpha}$

$1 + \frac{ctg^2\alpha}{\sin^2\alpha} = \frac{\sin^2\alpha + ctg^2\alpha}{\sin^2\alpha} = \frac{1}{\sin^2\alpha}$

$\sin\alpha = \frac{1}{\pm\sqrt{1 + ctg^2\alpha}}$

$\cos\alpha = \frac{ctg\alpha}{\pm\sqrt{1 + ctg^2\alpha}}$

26.01.2006р.

Класна робота

Варіант 1.

а) $90^\circ = \frac{\pi}{2}$ рад г) $10^\circ = \frac{\pi}{18}$ рад ґ) $216^\circ = \frac{6\pi}{5}$ рад

д) $60^\circ = \frac{\pi}{3}$ рад е) $45^\circ = \frac{\pi}{4}$ рад є) $-720^\circ = -4\pi$ рад

ж) $300^\circ = \frac{5\pi}{3}$ рад з) $72^\circ = \frac{2\pi}{5}$ рад и) $1200^\circ = \frac{20\pi}{3}$ рад

і)

Варіант 2

а) 2π рад $= 360^\circ$ г) $\frac{3\pi}{5}$ рад $= 108^\circ$ ґ) $-\frac{\pi}{36}$ рад $= -5^\circ$

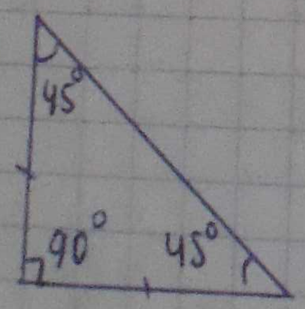
д) $-\pi$ рад $= -180^\circ$

е) $-\frac{7\pi}{12}$ рад $= -105^\circ$ є) $12{,}5\pi$ рад $= 2250^\circ$

ж) $\frac{\pi}{5}$ рад $= 36^\circ$

Варіант 3.

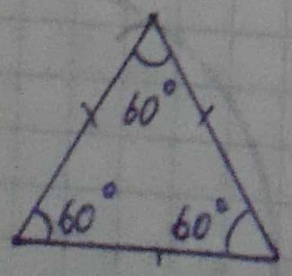
а)



$45^\circ = \frac{\pi}{4}$ рад

$90^\circ = \frac{\pi}{2}$ рад.

д)



$60^\circ = \frac{\pi}{3}$ рад

№4

ш) $\alpha = \frac{\pi}{2}$ рад $= 90°$

$\beta = 85°$

$\alpha > \beta$

е) $\alpha = \frac{\pi}{5}$ рад $= 36°$

$\beta = 40°$

$\alpha < \beta$

я) $\alpha = \frac{\pi}{10}$ рад $= 18°$

$\beta = 17°$

$\alpha > \beta$

з) $\alpha = \frac{2\pi}{3} = 120°$

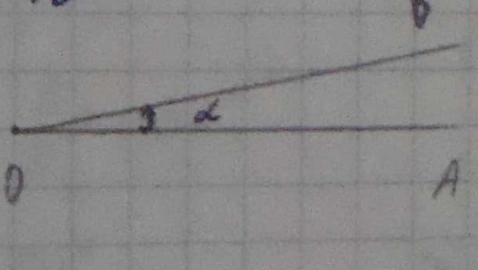
$\beta = 130°$

$\beta > \alpha$

№5

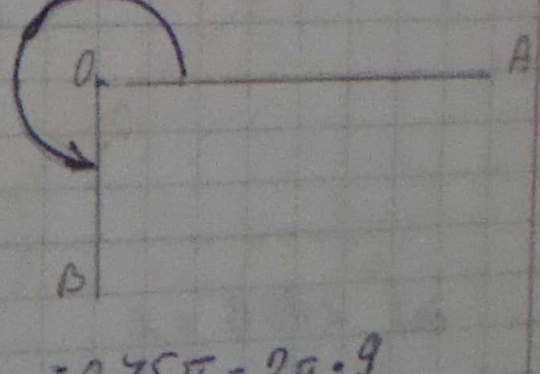
ш) $\alpha = 730° = 10° + 2 \cdot 360°$

$\alpha = 10°$



е) $\alpha = 19{,}5\pi$ рад $= 1{,}5\pi + 2\pi \cdot 9$

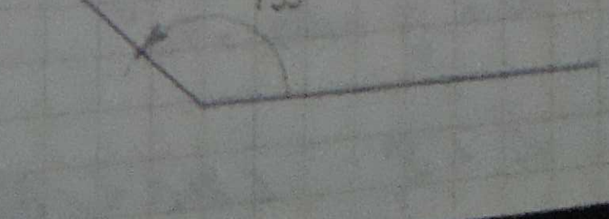
$\alpha = 1{,}5\pi = 270°$



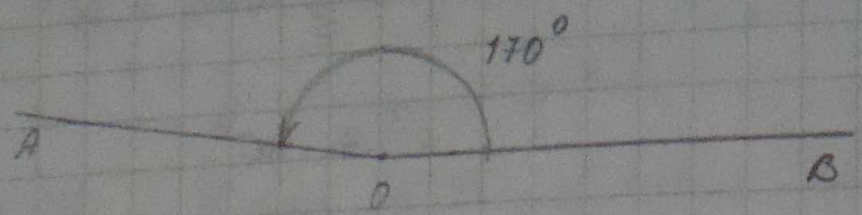
я) $\alpha = -17{,}25\pi$ рад $= 0{,}75\pi - 18\pi = 0{,}75\pi - 2\pi \cdot 9$

$0{,}75\pi = 18 \cdot 7{,}5 = 135°$

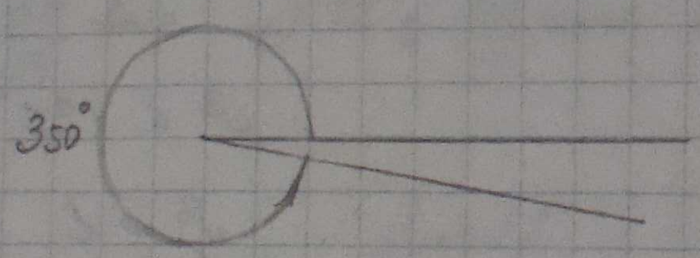
$\alpha = 135°$



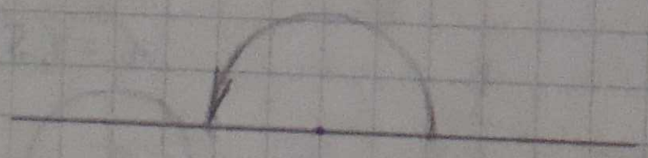
а) $\alpha = -550^\circ = 360^\circ - 190^\circ - 2360^\circ = 170^\circ - 2360^\circ$



б) $\alpha = -10^\circ = 360^\circ - 10^\circ - 360^\circ = 350^\circ - 360^\circ$



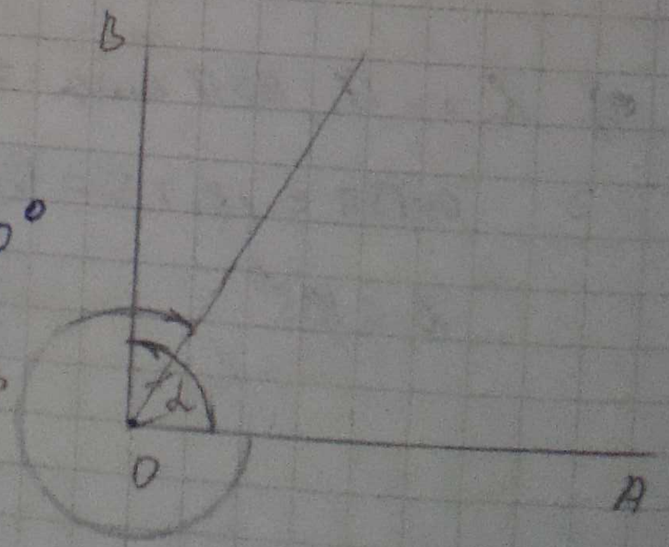
в) $\alpha = 1221/\pi$ рад $= \pi + 610 \cdot 2\pi$



Задача 6.

а) $\angle AOB = \alpha$

$\angle AOC = \beta$



в) $\alpha = \frac{\pi}{4}$ рад $\beta = -300^\circ$

$\alpha = \frac{\pi}{4}$ рад $= 90^\circ$

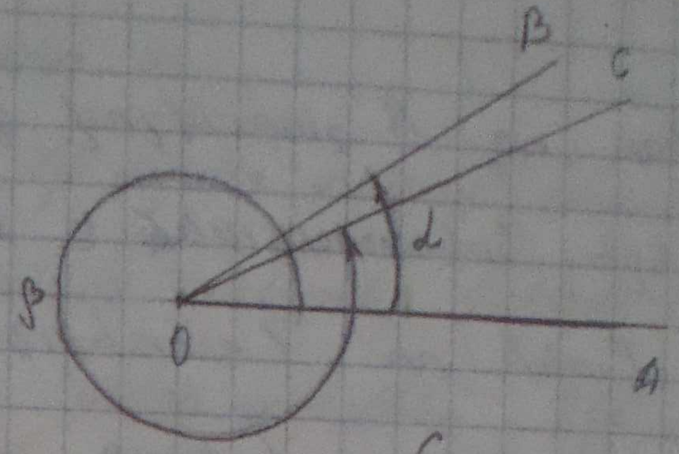
$\alpha < \beta$ $\angle AOB < \angle AOC$

а) $\alpha = \frac{\pi}{5}$ рад $= 36°$ β

$\beta = 390° = 30° + 360°$

$\alpha < \beta$

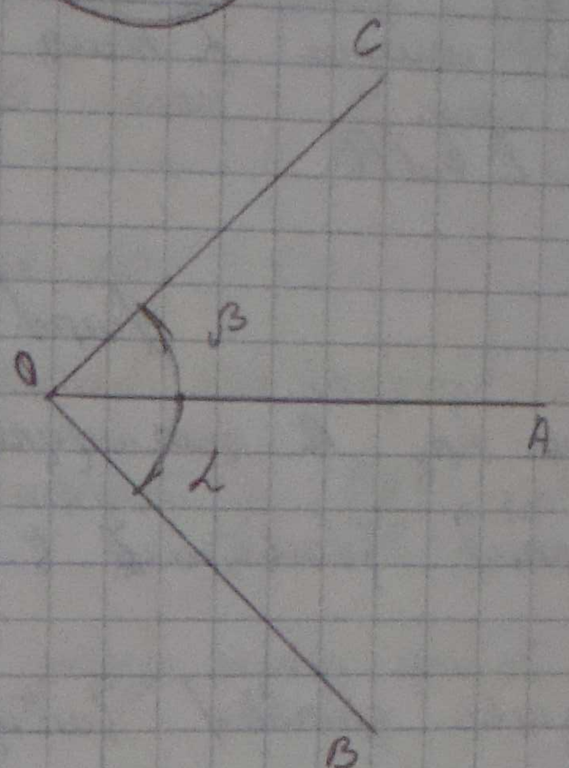
$\angle AOB \underset{\alpha}{<} \angle AOC$



б) $\alpha = -\frac{\pi}{4} = -45°$

$\beta = 45°$

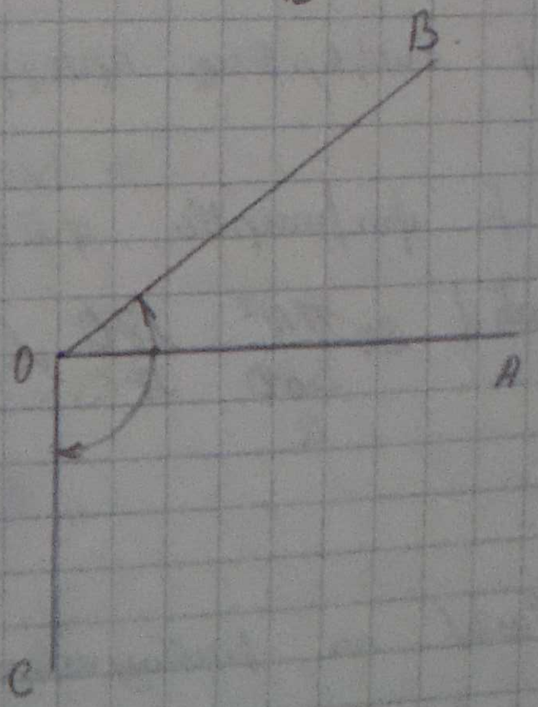
$\angle AOB = \angle AOC$



в) $\alpha = \frac{\pi}{5}$ рад $= 36°$

$\beta = -90°$

$\angle AOB < \angle AOC$



(Հարց 7)

Ապ., որ R շառավղով շրջանագծի l աղեղով ընկած կենտրոնային $\angle$ը $l = \alpha \angle R$.

Լուծ. որ 1°-ով աղեղի երկարությունը $\angle R$ է, ապա α°-ով $\angle R$-ի $l = \alpha \angle R$

Հարց 8

Ապ. որ, R շառավղով շրջանագծի $\angle$ աղեղով սեկտորի մակերեսը S $S = \frac{\angle R^2}{2}$:

Նկատի ունենք համեմատական $\angle$ի վրա կենտրոնային $\angle$ի մեծությունը πR^2 է 360°. $\angle$ աղեղով $\angle$ի $\frac{180}{\pi}\angle$ համեմատական $S = \frac{\pi R^2}{360} \cdot \frac{180}{\pi} \cdot \angle = \frac{\angle R^2}{2}$:

Հարց 7

Լուծ. որ համապատասխան $\angle$ով կենտրոնական անկյան աղեղի երկարությունը $\frac{\angle \pi R}{180}$ է, ապա 1°-ի վրա կենտրոնական $\angle$ի $\frac{180}{\pi}$-ով համա-

Энэ л $l = \alpha R$;

Жишээ 9

Энэшүүр цэгүүдэд 1 цагийн хугацаанд, нэг цагийн зүүний хөдөлгөөний чиглэлээс эсрэг $-360°$, тэр энэ зүүний хөдөлгөөнийг $-\frac{360°}{12} = 30°$ гэцгээнэ. $-30°$ ба $-360°$ нь $-\frac{\pi}{6}$ рад ба -2π рад:

Жишээ 10

Энэшүүр цэгүүдэд 1 энэ бүх зүүний, энэ зүүний хөдөлгөөнийг $\frac{360}{12} = 30°$ эсвэл $\frac{\pi}{6}$ рад өнцгөөр, тэр нэг цагт зүүний цэг $360°$ эсвэл 2π рад. өнцгөөр:

Жишээ 11

$a_1 = -7$

$d = 1,5$

$a_n > 0$

$a_n - ?$

$a_n > 0$

$a_1 + (n-1)d > 0$

$n > 1 - \frac{a_1}{d}$

$n > 1 + \frac{7}{1,5}$

$n > 5\frac{2}{3}$ $n = 6; 7; \dots$

$a_6 = -7 + 5 \cdot 1,5 = 0,5$ Тэр: 0,5

?

ф) $a_2 = 15\pi$

$a_4 = 11\pi$

$a_n > 0$

$a_n - ?$

$a_n > 0$

$\begin{cases} a_1 + d = 15\pi \\ a_1 + 3d = 11\pi \end{cases} \Leftrightarrow \begin{cases} 2d = -4\pi \\ \end{cases} \Leftrightarrow$

$\Leftrightarrow \begin{cases} d = -2\pi \\ a_1 = 17\pi \end{cases}$

$a_n > 0 \Leftrightarrow a_1 + (n-1)d > 0$

$17\pi - 2\pi(n-1) > 0 \quad n > 1 - \frac{a_1}{d}$

$2\pi(n-1) - 17\pi < 0$

$n < \frac{17\pi}{2\pi} + 1$

$n > 1 + \frac{17\pi}{2\pi}$

$n < 9{,}5$

$n > 9{,}5$

$n = 9$

$a_9 = 17\pi - 16\pi = \pi$

Дыр: $a_9 = \pi$

2/ шаг 12

$a_4 = -8\pi$

$a_{17} = 5\pi$

$a_n < 0$

$a_n - ?$

$\begin{cases} a_1 + 3d = -8\pi \\ a_1 + 16d = 5\pi \end{cases} \Leftrightarrow \begin{cases} 13d = 13\pi \\ d = \pi \end{cases}$

$a_1 = -8\pi - \pi = -9\pi$

$a_n > 0 \Leftrightarrow a_1 + (n-1)d > 0$

$n > 1 - \frac{a_1}{d}$

$n > 1 + 3 + 8\pi$ 10

$a_n < 0$

$n < 10$

$a_{10} = -9\pi + 9\pi = 0$

$a_9 = -9\pi + 8\pi = -\pi$

Тому: $a_9 = -\pi$

г) $a_1 = 21$

$d = -2,2$

$a_n < 0$

$a_n - ?$

$a_n < 0$

$a_1 + (n-1)d < 0$

$\left(n < 1 + \frac{a_1}{d}\right)$

$21 - (n-1) \cdot 2,2 < 0$

$2,2 \cdot (n-1) - 21 > 0$

$n > \frac{21}{2,2} + 1$

$n > \frac{29,2}{2,2}$ $\quad n > 10\frac{6}{11}$ $n = 12$

$a_{12} = 21 - 24,2 =$

$a_{11} = 21 - 22 = -1$

Тому: $a_{11} = -1$

2 варіант 13

ш) $a_n = 5 - 1,3(n-1) \Rightarrow$

$\Rightarrow a_1 = 5$

$d = -1,3$

$a_n \in [-0,5; 0]$

$a_n - ?$

$-0,5 \le a_n \le 0$

$-0,5 \le 5 - 1,3(n-1) \le 0$

$0 \le 1,3(n-1) + 5 \le 0,5$

$\frac{5}{1,3} + 1 \le n \le \frac{0,5+5}{1,3} + 1$

$$\frac{6,3}{1,3} \le n \le \frac{6,8}{1,3}$$

$$\frac{63}{13} \le n \le \frac{68}{13}$$

$$4\frac{11}{13} \le n \le 5\frac{3}{13}$$

$n = 5 \quad a_5 = 5 - 1,3 \cdot 4 = -0,2$

Ответ: $a_5 = -0,2$

б) $a_n = \frac{\pi}{2} \cdot n$

$a_n \in (7\pi ; 7,7\pi]$

$7\pi < a_n \le 7,7\pi$

~~$7\pi < a_1 + (n-1)d$~~

$7\pi < \frac{\pi}{2} n \le 7,7\pi$

$14 < n \le 15,4$

$n = 15$

$a_{15} = \frac{15\pi}{2}$

Ответ: $\frac{15\pi}{2} = a_{15}$.

г) Ответ: 14.

$a_1 = 4$

$d = 7$

д) $a_n \in [20; 50]$

$a_n - ?$

$20 \le a_n \le 50$

$20 \le a_1 + (n-1)d \le 50$

$$\frac{20-a_1}{d}+1 \le n \le \frac{50-a_1}{d}+1$$

$$\frac{20-4}{7}+1 \le n \le \frac{50-4}{7}+1$$

$$\frac{23}{7} \le n \le \frac{53}{7}$$

$$3\frac{2}{7} \le n \le 7\frac{4}{7}$$

$n = 4; 5; 6; 7$

$a_4 = 4+21 = 25$

$a_5 = 32$

$a_6 = 39$

$a_7 = 46$

Ответ: 25; 32; 39; 46.

г) $a_n \in [60; 90]$

$$60 \le a_n \le 90$$

$$60 \le a_1 + (n-1)d \le 90$$

$$\frac{60-a_1}{d}+1 \le n \le \frac{90-a_1}{d}+1$$

$$\frac{56}{7}+1 \le n \le \frac{86}{7}+1$$

$$9 \le n \le 13\frac{2}{7}$$

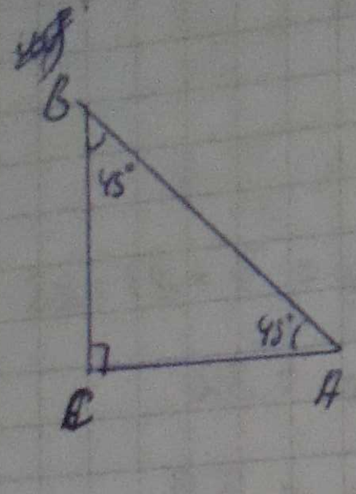
$n = 9; 10; 11; 12; 13; 14$

$a_9 = 60$; $a_{10} = 67$; $a_{11} = 74$; $a_{12} = 81$; $a_{13} = 88$; ~~$a_{14} = 95$~~

Задача 15.

Дано: $\triangle ABC$ $AC = BC$,

найти: $\sin 45^\circ$, $\cos 45^\circ$, $\operatorname{tg} 45^\circ$



Решение: По теореме Пифагора

$AB^2 = BC^2 + AC^2 = A$

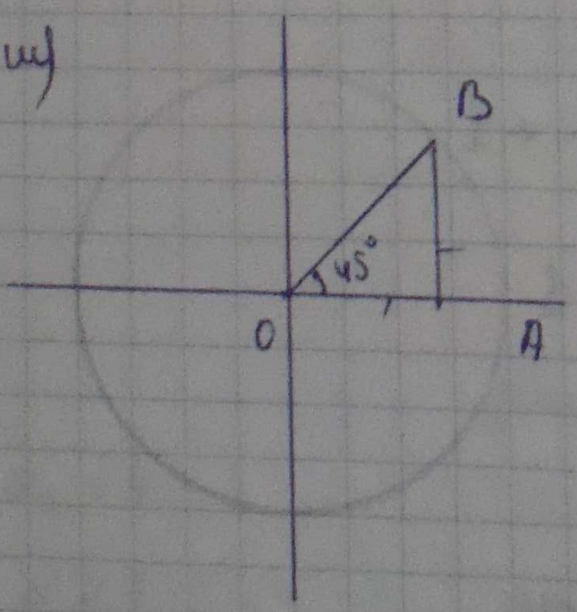
$= 2BC^2 = 2AC^2$

$$\sin 45^\circ = \frac{BC}{AB} = \frac{BC}{BC\sqrt{2}} = \frac{\sqrt{2}}{2}$$

$$\cos 45^\circ = \frac{AC}{AB} = \frac{AC}{AC\sqrt{2}} = \frac{\sqrt{2}}{2}$$

$$\operatorname{tg} 45^\circ = \frac{\sin 45^\circ}{\cos 45^\circ} = 1$$

Ш)



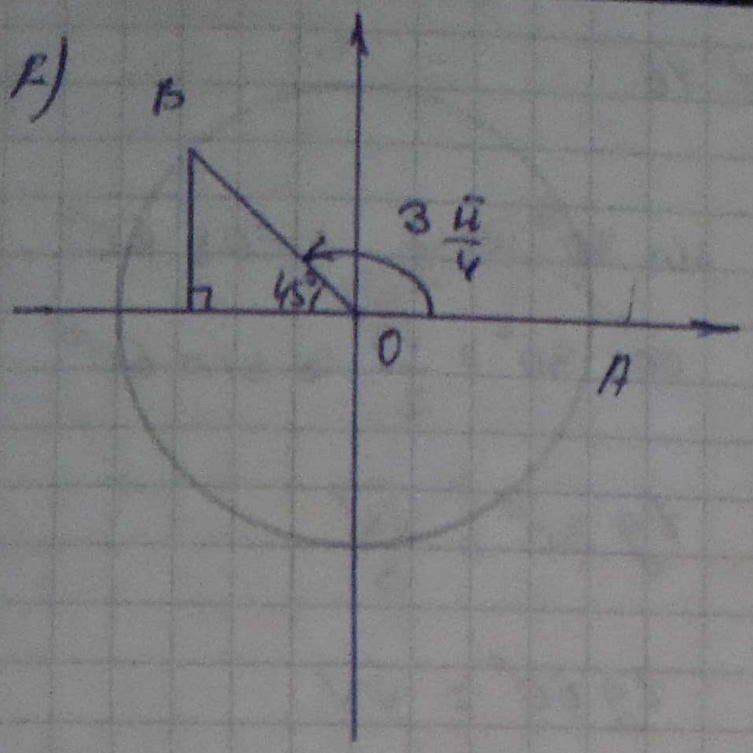
$\sin 45^\circ = y = \frac{\sqrt{2}}{2}$

$\cos 45^\circ = x = \frac{\sqrt{2}}{2}$

$\operatorname{tg} 45^\circ = 1$

$\operatorname{ctg} 45^\circ = 1$

А)



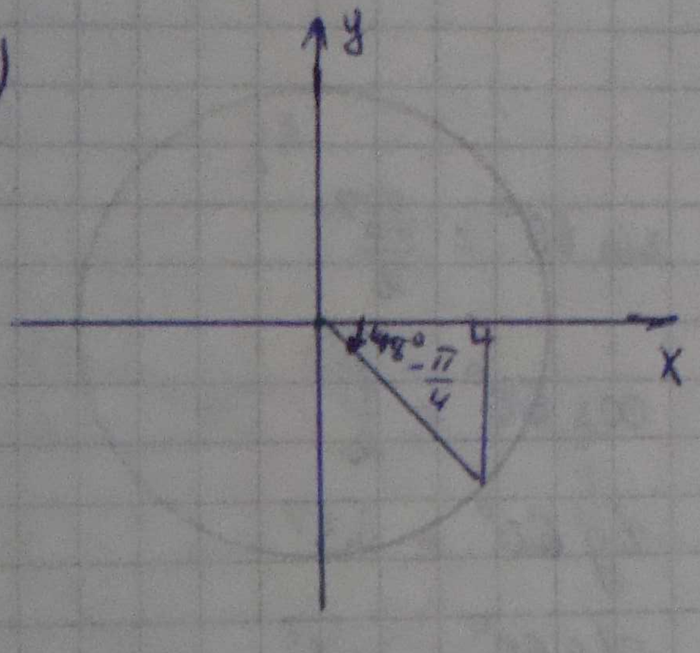
$$\sin\left(\frac{3\pi}{4}\right) = \frac{\sqrt{2}}{2}$$

$$\cos\left(\frac{3\pi}{4}\right) = -\frac{\sqrt{2}}{2}$$

$$tg\left(\frac{3\pi}{4}\right) = -1$$

$$ctg\left(\frac{3\pi}{4}\right) = -1$$

Б)



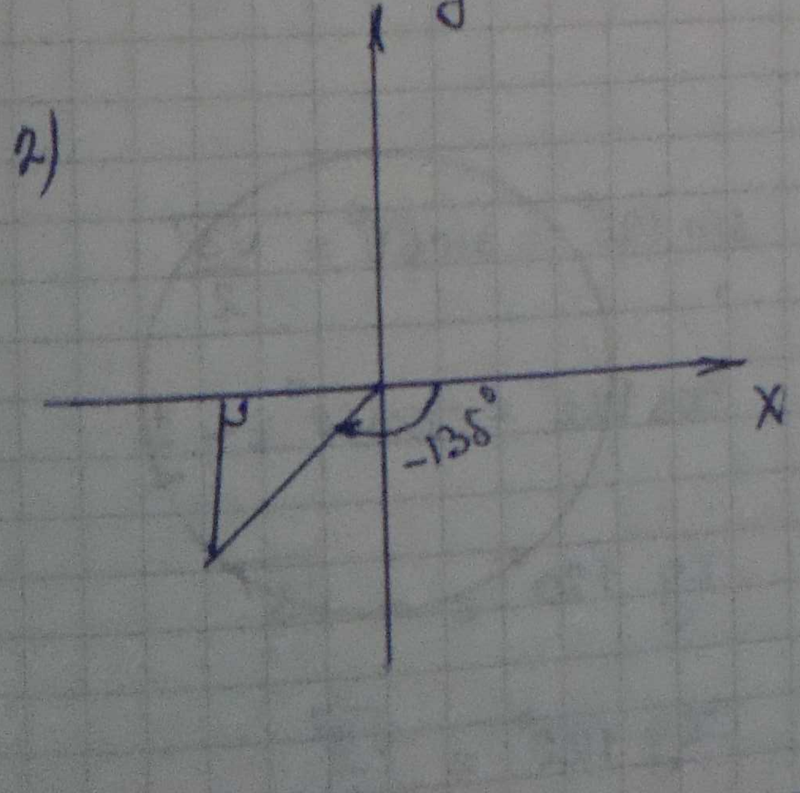
$$\sin\left(-\frac{\pi}{4}\right) = -\frac{\sqrt{2}}{2}$$

$$\cos\left(-\frac{\pi}{4}\right) = \frac{\sqrt{2}}{2}$$

$$tg\left(-\frac{\pi}{4}\right) = -1$$

$$ctg\left(-\frac{\pi}{4}\right) = -1$$

В)



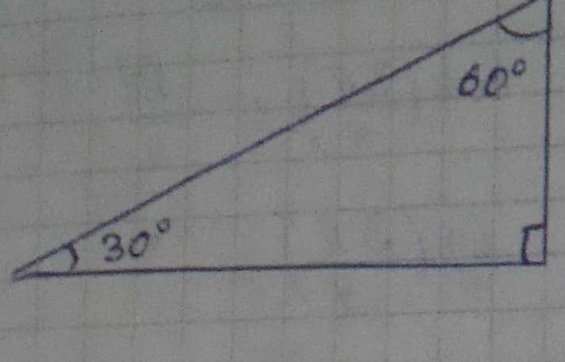
$$\sin(-135) = -\frac{\sqrt{2}}{2}$$

$$\cos(-135^\circ) = -\frac{\sqrt{2}}{2}$$

$$tg(-135^\circ) = 1$$

$$ctg(-135^\circ) = 1$$

2/ura d 16



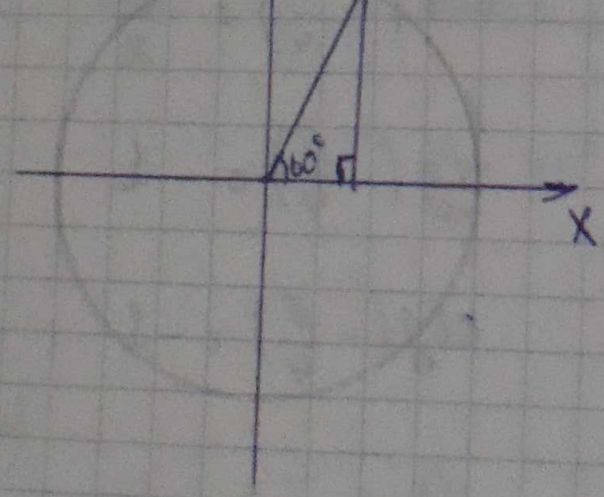
$\sin 30^\circ = \frac{1}{2} = \cos 60^\circ$

$\cos 30^\circ = \frac{\sqrt{3}}{2} = \sin 60^\circ$

$tg\, 30^\circ = \frac{\sqrt{3}}{3}$

$tg\, 60^\circ = \sqrt{3}$

ա) 60°



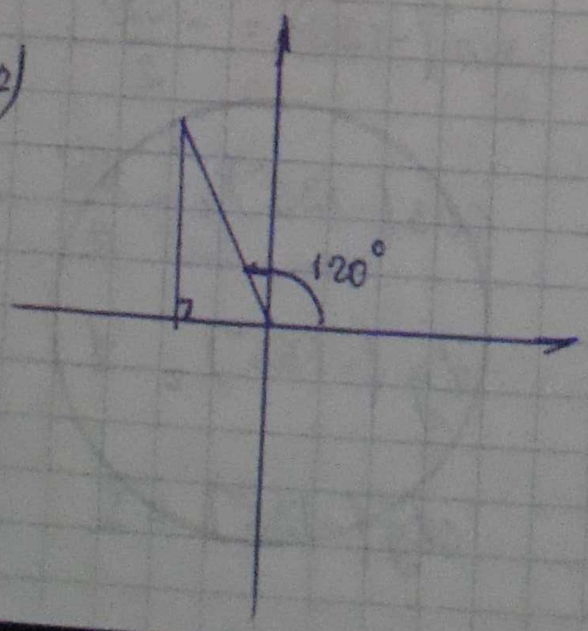
$\sin 60^\circ = \frac{\sqrt{3}}{2}$

$\cos 60^\circ = \frac{1}{2}$

$tg\, 60^\circ = \sqrt{3}$

$ctg\, 60^\circ = \frac{\sqrt{3}}{3}$

բ)



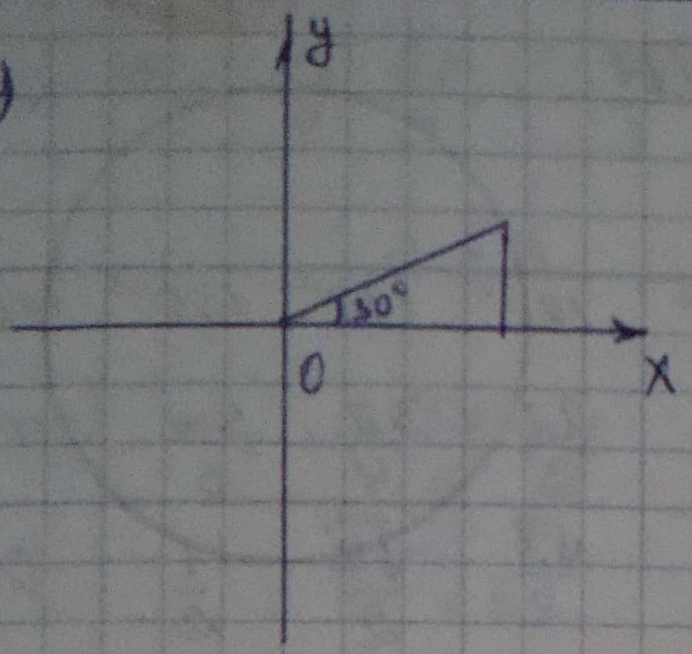
$\sin 120^\circ = \sin 60^\circ = \frac{\sqrt{3}}{2}$

$\cos 120^\circ = -\cos 60^\circ = -\frac{1}{2}$

$tg\, 120^\circ = -\sqrt{3}$

$ctg\, 120^\circ = \frac{\sqrt{3}}{3}$.

9)



$\sin 30° = \frac{1}{2}$

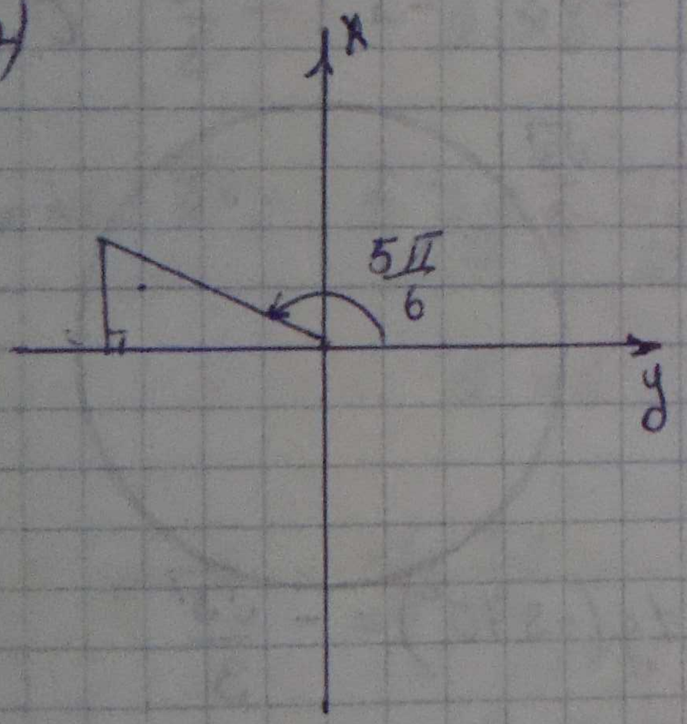
$\sin\left(\frac{\pi}{6}\right) = \frac{1}{2}$

$\cos\left(\frac{\pi}{6}\right) = \frac{\sqrt{3}}{2}$

$tg\left(\frac{\pi}{6}\right) = \frac{\sqrt{3}}{3}$

$ctg\left(\frac{\pi}{6}\right) = \sqrt{3}$

7)



$\sin\left(\frac{5\pi}{6}\right) = \frac{1}{2}$

$\cos\left(\frac{5\pi}{6}\right) = -\frac{\sqrt{3}}{2}$

$tg\left(\frac{5\pi}{6}\right) = -\frac{\sqrt{3}}{3}$

$tg\left(\frac{5\pi}{6}\right) = -\sqrt{3}$

Задача 17

α	$0°$ 0	$30°$ $\frac{\pi}{6}$	$45°$ $\frac{\pi}{4}$	$60°$ $\frac{\pi}{3}$	$90°$ $\frac{\pi}{2}$	$120°$ $\frac{2\pi}{3}$	$135°$ $\frac{3\pi}{4}$	$150°$ $\frac{5\pi}{6}$	$180°$ π
$\sin\alpha$	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0
$\cos\alpha$	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0	$-\frac{1}{2}$	$-\frac{\sqrt{2}}{2}$	$-\frac{\sqrt{3}}{2}$	-1
$\operatorname{tg}\alpha$	~~не сущ.~~ 0	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$	не сущ.	$-\sqrt{3}$	-1	$-\frac{\sqrt{3}}{3}$	0
$\operatorname{ctg}\alpha$	не сущ.	$\sqrt{3}$	1	$\frac{\sqrt{3}}{3}$	0	$-\frac{\sqrt{3}}{3}$	-1	$-\sqrt{3}$	не сущ.

Задача 18

а) $\sin 9\frac{\pi}{4} = \frac{\sqrt{2}}{2}$

б) $\sin\left(-\frac{11\pi}{6}\right) = \frac{1}{2}$

в) $\cos\frac{19\pi}{4} = -\frac{\sqrt{2}}{2}$

г) $\cos 810° = 0$

д) $\operatorname{tg}\frac{13\pi}{6} = \frac{\sqrt{3}}{3}$

е) $\operatorname{tg}(-570°) = -\frac{\sqrt{3}}{3}$

Задача 19.

а) $a = \sin\frac{\pi}{3} = \frac{\sqrt{3}}{2}$ $\quad b = \cos\frac{\pi}{6} = \frac{\sqrt{3}}{2}$

$a = b.$

180°
π
0
1
0

е) $a = tg\frac{2\pi}{3} = -\frac{\sqrt{3}}{3}$ $b = ctg\frac{2\pi}{3} = -\sqrt{3}$

$a > b$

ж) $a = \sin\frac{5\pi}{6} = \frac{1}{2}$ $b = tg\frac{\pi}{3} = \sqrt{3}$

$a < b$

з) $a = \cos\frac{2\pi}{3} = -0{,}5$ $b = \cos\frac{3\pi}{4} = -\frac{\sqrt{2}}{2}$

$a > b$

и) $a = \sin\frac{3\pi}{4} = \frac{\sqrt{2}}{2}$ $b = \cos\frac{\pi}{4} = \frac{\sqrt{2}}{2}$

$a = b$

к) $a = ctg\frac{3\pi}{4} = -1$ $b = \cos\frac{5\pi}{6} = -\frac{\sqrt{3}}{2}$

$a < b$

2 вариант 20.

а) $\sin\frac{\pi}{6} + \sin\frac{\pi}{4} \cdot \cos\frac{\pi}{4} = \frac{1}{2} + \frac{\sqrt{2}}{2} \cdot \frac{\sqrt{2}}{2} = 1$

б) $\cos\pi + 2\cos\frac{\pi}{3} = -1 + 2 \cdot \frac{1}{2} = 0$

в) $2\sin\frac{\pi}{3} + tg\frac{\pi}{4} = 2 \cdot \frac{\sqrt{3}}{2} + 1 = \sqrt{3} + 1$

ж) $\operatorname{tg}\frac{\pi}{3} \cdot \operatorname{ctg}\frac{2\pi}{3} + \sin\pi =$

$= \sqrt{3} \cdot \left(-\frac{\sqrt{3}}{3}\right) + 0 = -1$

з/мұнд 21

ш) $\sin^2\frac{3\pi}{4} + \cos^2\frac{3\pi}{4} = \left(\frac{\sqrt{2}}{2}\right)^2 + \left(-\frac{\sqrt{2}}{2}\right)^2 =$

$= \frac{2}{4} + \frac{2}{4} = 1$

ы) $\operatorname{tg}\frac{5\pi}{6} \cdot \sin\frac{\pi}{3} + \cos\frac{\pi}{2} =$

$= -\frac{\sqrt{3}}{3} \cdot \frac{\sqrt{3}}{2} + 0 = -0{,}5$

э) $\operatorname{ctg}\frac{5\pi}{6} \cdot \operatorname{tg}\frac{\pi}{6} = -\sqrt{3} \cdot \frac{\sqrt{3}}{3} = -1$

ю) $4\cos\frac{\pi}{4} \cdot \cos\frac{3\pi}{4} \cdot \sin\frac{3\pi}{4} =$

$= 2\sqrt{2} \cdot \left(-\frac{\sqrt{2}}{2}\right) \cdot \frac{\sqrt{2}}{2} = -\sqrt{2}$

я/мұнд 22

ш) $2\sin 30^\circ + \sqrt{3}\operatorname{tg} 60^\circ = 2 \cdot \frac{1}{2} + \sqrt{3} \cdot \sqrt{3} = 4$

ы) $7\sqrt{3}\cos 30^\circ - 3\sin 150^\circ = 7\sqrt{3} \cdot \frac{\sqrt{3}}{2} - 3 \cdot \frac{1}{2} =$

$= \frac{21}{2} - \frac{3}{2} = 9$

е) $\operatorname{tg}135^\circ \cdot \cos 120^\circ + 3\cos 60^\circ = -1 \cdot \left(-\frac{1}{2}\right) + 3 \cdot \frac{1}{2} =$

$= \frac{1}{2} + \frac{3}{2} = 2$

ж) $\operatorname{ctg}60^\circ \cdot \operatorname{tg}120^\circ + \cos 150^\circ \cdot \sin 60^\circ = \frac{\sqrt{3}}{3} \cdot (-\sqrt{3}) +$

$+ \frac{\sqrt{3}}{2} \cdot \frac{\sqrt{3}}{2} = -1 - \frac{3}{4} = -\frac{7}{4} = -1\frac{3}{4} = -1,75$

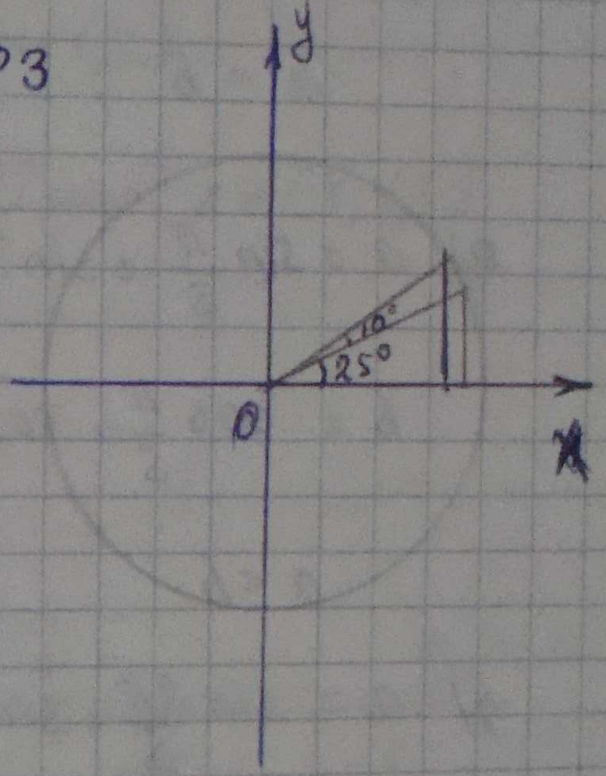
з) z/шуд 23

$\sin 25^\circ > \sin$

и) $a = \sin 25^\circ$

$b = \sin 35^\circ$

$a < b$



к) $a = \cos 25^\circ$

$b = \cos 35^\circ$

$a > b$

л) $a = \sin \frac{3\pi}{8} = 67^\circ 30'$

$b = \sin 35^\circ$

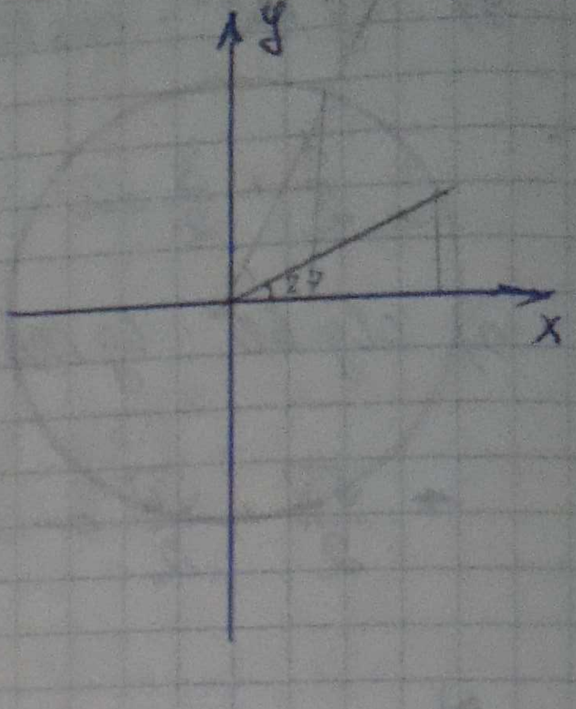
$a > b$

м) $a = \cos 82^\circ$

$b = \cos \frac{\pi}{3} = 60^\circ$

$a < b$

Ұлгері 24



ж) $a = \sin 27^\circ$

$b = \cos 27^\circ = \sin 63^\circ$

$a < b$

е) $a = \cos 73^\circ$

$b = \sin 73^\circ = \cos 17^\circ$

$a < b$

қ) $a = \sin \frac{\pi}{5} = \sin 36^\circ$

$b = \cos \frac{\pi}{5} = \cos 36^\circ = \sin 54^\circ$

$a < b$

з) $a = \sin \frac{2\pi}{5} = \sin 72^\circ$

$b = \cos 72^\circ = \sin 18^\circ$

$a > b$

Ұлгері 25

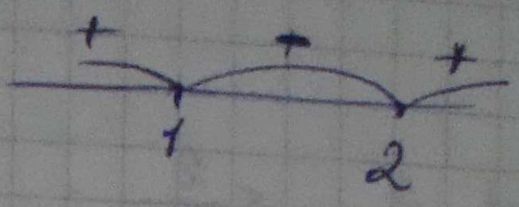
ш) $\begin{cases} x^2 - 3x + 2 \leq 0 \\ 2x - 3 < 0 \end{cases}$

$x^2 - 3x + 2 \leq 0$

$x^2 - 3x + 2 = 0$

$D = 9 - 8 = 1$

$x_{1;2} = \frac{3 \pm 1}{2} \begin{matrix} \nearrow 1 \\ \searrow 2 \end{matrix}$



~~$x \in (-\infty; 1] \cup [2; +\infty)$~~ $x \in [1; 2]$

$$\begin{cases} x \in (-\infty; 1] \cup [2; +\infty) \\ \begin{cases} x \in [1; 2] \\ x \in (-\infty; 1{,}5) \end{cases} \end{cases} \Rightarrow x \in [1; 1{,}5]$$

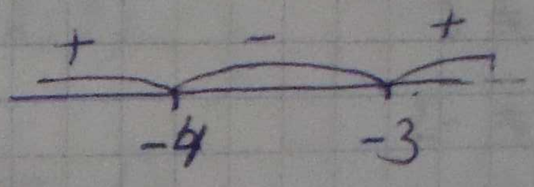
Ответ: $x \in [1; 1{,}5]$

Б) $\begin{cases} x^2 + 7x + 12 \geq 0 \\ 2x + 10 > 0 \end{cases}$

$x^2 + 7x + 12 = 0$

$D = 49 - 48 = 1$

$x_{1;2} = \frac{-7 \pm 1}{2} \begin{matrix} \nearrow -4 \\ \searrow -3 \end{matrix}$



$$\begin{cases} x \in (-\infty; -4] \cup [-3; +\infty) \\ x \in (-5; +\infty) \end{cases} \Rightarrow x \in (-5; -4] \cup [-3; +\infty)$$

Ответ: $x \in (-5; -4] \cup [3; +\infty)$

Домашняя работа 26

а) $\frac{5}{x-6} \leq \frac{2}{x+1}$

$\frac{5}{x-6} - \frac{2}{x+1} \leq 0$

$\frac{5(x+1)-2(x-6)}{(x-6)(x+1)} \leq 0$

$\frac{5x+5-2x+12}{(x-6)(x+1)} \leq 0$

$\frac{3x+17}{(x-6)(x+1)} \leq 0$

р.ш.ф. $x \neq 6$

$x \neq -1$

$\left[\begin{cases} 3x+17 \geq 0 \\ (x-6)(x+1) < 0 \end{cases} \Rightarrow \begin{cases} x \geq -\frac{17}{3} \\ x \in (-1;6) \end{cases} \Rightarrow \begin{cases} x \in [-5\frac{2}{3}; +\infty) \\ x \in (-1;6) \end{cases} \Rightarrow x \in (-1;6)$

$\left[\begin{cases} 3x+17 \leq 0 \\ (x-6)(x+1) > 0 \end{cases} \Rightarrow \begin{cases} x < -\frac{17}{3} \\ x \in (-\infty;-1) \cup (6;+\infty) \end{cases} \Rightarrow \begin{cases} x \in (-\infty; -5\frac{2}{3}) \\ x \in (-\infty;-1) \cup (6;+\infty) \end{cases}$

$\Rightarrow \left[\begin{array}{l} x \in (-\infty; -5\frac{2}{3}) \\ x \in (-1;6) \end{array}\right. \Rightarrow x \in (-\infty; -5\frac{2}{3}) \cup (-1;6)$

Ответ: $x \in (-\infty; -5\frac{2}{3}) \cup (-1;6)$

г) $\frac{3}{2-x} \geq \frac{1}{x+2}$

$\frac{3}{-(x-2)} - \frac{1}{x+2} \geq 0$

$\frac{3}{x-2} + \frac{1}{x+2} \leq 0$

$\frac{3x+6+x-2}{(x-2)(x+2)} \leq 0$

$\frac{4(x+1)}{(x-2)(x+2)} \leq 0$ р.ш.р $x \neq \pm 2$

$$\left[\begin{array}{l} \begin{cases} x+1 \geq 0 \\ (x-2)(x+2) < 0 \end{cases} \Rightarrow \begin{cases} x \in [-1; +\infty) \\ x \in (-2; 2) \end{cases} \Rightarrow x \in [-1; 2) \\ \begin{cases} x+1 < 0 \\ (x-2)(x+2) > 0 \end{cases} \Rightarrow \begin{cases} x \in (-\infty; -1) \\ x \in (-\infty; -2) \cup (2; +\infty) \end{cases} \Rightarrow x \in (-\infty; -2) \end{array}\right.$$

$$\left[\begin{array}{l} x \in [-1; 2) \\ x \in (-\infty; -2) \end{array}\right. \Rightarrow x \in (-\infty; -2) \cup [-1; 2)$$

Ответ: $x \in (-\infty; -2] \cup [1; 2)$

Задача 27.

а) $\alpha = 85^\circ$, $\alpha \in$ I чет. ($0^\circ < \alpha < 90^\circ$)

б) $\alpha = 185^\circ \Rightarrow 180^\circ < \alpha < 270^\circ \Rightarrow \alpha \in$ III чет.

в) $\alpha = -450^\circ = 90^\circ - 2 \cdot 360^\circ$, $\alpha \notin$ ни одной чет.

г) $\alpha = 790^\circ = 70 + 2 \cdot 360^\circ$, $0^\circ < \alpha < 90^\circ \Rightarrow \alpha \in$ I чет.

д) $\alpha = -18^\circ = 342^\circ - 360^\circ$; $270 < \alpha < 360^\circ \Rightarrow \alpha \in$ IV чет.

е) $\alpha = 298^\circ \Rightarrow 270^\circ < \alpha < 360^\circ \Rightarrow \alpha \in$ IV чет.

Задача 28

а) $\alpha = \frac{3\pi}{4}$, $\frac{\pi}{2} < \frac{3\pi}{4} < \pi \Rightarrow \alpha \in$ II чет.

б) $\alpha = \frac{5\pi}{4} = 1{,}25\pi$, $\pi < 1{,}25\pi < 1{,}5\pi \Rightarrow \alpha \in$ III чет.

в) $\alpha = -\frac{\pi}{10} = -0{,}1\pi = 1{,}9\pi - 2\pi \Rightarrow 1{,}5\pi < \alpha < 2\pi \Rightarrow \alpha \in$ IV чет.

г) $\alpha = 1{,}5 = \left(\frac{1{,}5}{3{,}14}\right)\pi \approx 0{,}48\pi$, $0 < \alpha < 0{,}5\pi \Rightarrow \alpha \in$ I чет.

д) $\alpha = 1{,}5\pi \Rightarrow \alpha$ не принадлежит ни одной четверти

е) $\alpha = \frac{11\pi}{6} \approx 1{,}83\pi$, $\alpha \in$ IV чет.

Задача 29

а) $\alpha = 12{,}25\pi = 0{,}25\pi + 6 \cdot 2\pi \Rightarrow \alpha \in$ I чет.

б) $\alpha = 7{,}5 = \left(\frac{750}{314}\right)\pi \approx 3{,}0\pi = \pi + 2{,}0\pi + 2\pi \Rightarrow \alpha \in$ III чет.

а) $\alpha = -6{,}25\pi = 1{,}75\pi - 2\pi \cdot 4 \Rightarrow \alpha \in$ IV четв

б) $\alpha = -3{,}14\pi = 0{,}86\pi - 2 \cdot 2\pi \Rightarrow \alpha \in$ II четв

в) $\alpha = 3{,}2 = \frac{320}{314}\pi \approx 1{,}0\pi \Rightarrow \alpha \in$ III четв

Задача 30

ж) $2{,}5\pi < \alpha < 2{,}7\pi$

$2{,}5\pi + 2\pi < \alpha < 0{,}7\pi + 2\pi$

$\alpha \in (0{,}5\pi; 0{,}7\pi) \Rightarrow \alpha \in$ II четв.

г) $-0{,}7\pi < \alpha < -0{,}6\pi$

$1{,}3\pi - 2\pi < \alpha < 1{,}4\pi - 2\pi$

$\alpha \in (1{,}3\pi; 1{,}4\pi) \Rightarrow \alpha \in$ III четв.

д) $(-0{,}7\pi < \alpha)\ 4{,}2\pi < \alpha < 4{,}5\pi$

$0{,}2\pi + 2 \cdot 2\pi < \alpha < 2 \cdot 2\pi + 0{,}5\pi$

$\alpha \in (0{,}2\pi; 0{,}5\pi) \Rightarrow \alpha \in$ I четв.

е) $1 < \alpha < \sqrt{2}$

$0{,}3\pi < \alpha < 0{,}4\pi$

$\alpha \in (0{,}3\pi; 0{,}4\pi) \Rightarrow \alpha \in$ I четв.

№ 31

в) $\pi < \alpha < 2\pi$ $\quad \alpha \in (\frac{\pi}{2}; \pi) \Rightarrow \alpha \in \underline{II}$ чет.

$\frac{\pi}{2} < \frac{\alpha}{2} < \pi$

г) $-3\pi < \alpha < -2\pi$

$\pi - 2\pi \cdot 2 < \alpha < 0 - 2\pi$

$\frac{\pi}{2} - 2\pi < \frac{\alpha}{2} < 0 - \pi$

$\frac{\alpha}{2} \in (\frac{\pi}{2} 0; \frac{\pi}{2}) \Rightarrow \frac{\alpha}{2} \in \underline{I}$ чет.

д) $2\pi < \alpha < 3\pi$

$0 + 2\pi < \alpha < \pi + 2\pi$ $\quad \alpha \in (\pi; 1{,}5\pi) \Rightarrow$

$0 + \pi < \frac{\alpha}{2} < 1{,}5\pi$ $\quad \Rightarrow \alpha \in \underline{III}$ чет.

е) $360^\circ < \alpha < 540^\circ$

$180^\circ < \frac{\alpha}{2} < 270^\circ \Rightarrow \alpha \in \underline{III}$ чет.

ё) $-360^\circ < \alpha < -180^\circ$

$-180^\circ < \frac{\alpha}{2} < -90^\circ$

$180^\circ < \frac{\alpha}{2} < 270^\circ \Rightarrow \alpha \in \underline{III}$ чет.

2.

д) $180° < \alpha < 360°$

$90° < \frac{\alpha}{2} < 180° \Rightarrow \alpha \in$ II чет.

2 чет. 32

е) $\cos\alpha > 0 \Rightarrow \alpha \in$ { I чет, IV чет

$tg\alpha > 0 \Rightarrow \alpha \in$ { I чет, III чет

$\Rightarrow \alpha \in$ I чет

ж) $\cos\alpha < 0 \Rightarrow \alpha \in$ { II чет, III чет

$ctg\alpha > 0 \Rightarrow \alpha \in$ { I чет, III чет

$\Rightarrow \alpha \in$ III чет

з) $\sin\alpha > 0 \Rightarrow \alpha \in$ { I чет, II чет

$tg\alpha < 0 \Rightarrow \alpha \in$ { II чет, IV чет

$\Rightarrow \alpha \in$ II чет

и) $ctg\alpha < 0 \Rightarrow \alpha \in$ { II чет, IV чет

$\cos\alpha < 0 \Rightarrow \alpha \in$ { II чет, III чет

$\Rightarrow \alpha \in$ II чет

к) $\sin\alpha < 0 \Rightarrow \alpha \in$ { III чет, IV чет

$\cos\alpha > 0 \Rightarrow \alpha \in$ { I чет, IV чет

$\Rightarrow \alpha \in$ IV чет

е) $\cos\alpha > 0 \Rightarrow \alpha \in$ { I четв. / IV четв.

$tg\alpha < 0 \Rightarrow \alpha \in$ { II четв. / III четв.

$\Rightarrow \alpha \in$ IV четв.

2 цифра 33

ж) $5\sin\alpha + \sqrt{3\cos\alpha} = 0$

$\sqrt{3\cos\alpha} = -5\sin\alpha$

$\begin{cases} \cos\alpha > 0 \\ \sin\alpha < 0 \end{cases} \Rightarrow \alpha \in$ IV четв.

з) $2tg\alpha + \sqrt{-7\cos\alpha} = 0$

$\sqrt{-7\cos\alpha} = -2tg\alpha$

$\begin{cases} \cos\alpha < 0 \\ tg\alpha < 0 \end{cases} \Rightarrow \alpha \in$ III четв.

и) $|\cos\alpha| = \cos\alpha$, $tg\alpha < 0$

$\begin{cases} \cos\alpha > 0 \\ tg\alpha < 0 \end{cases} \Rightarrow \alpha \in$ IV четв.

к) $|\sin\alpha| = \sin\alpha$, $ctg\alpha < 0$

$\begin{cases} \sin\alpha > 0 \\ ctg\alpha < 0 \end{cases} \Rightarrow$ II четв.

Задача 34

а) $\alpha = 158^\circ \Rightarrow 90 < \alpha < 180^\circ \Rightarrow \alpha \in \underline{II}$ чверт $\Rightarrow$

$\Rightarrow \sin\alpha > 0,\ \cos\alpha < 0,\ tg\alpha < 0,\ ctg\alpha < 0$

б) $\alpha = 1{,}3\pi \Rightarrow \pi < \alpha < 1{,}5\pi \Rightarrow \alpha \in \underline{III}$ чверт $\Rightarrow$

$\Rightarrow \sin\alpha < 0,\ \cos\alpha < 0,\ tg\alpha > 0,\ ctg\alpha > 0$

в) $\alpha = 0{,}3\pi \Rightarrow 0\pi < \alpha < 0{,}5\pi \Rightarrow \alpha \in \underline{I}$ чверт $\Rightarrow$

$\Rightarrow \sin\alpha > 0,\ \cos\alpha > 0,\ tg\alpha > 0,\ ctg\alpha > 0$

г) $\alpha = 355^\circ \Rightarrow$ ✗ $270^\circ < \alpha < 360^\circ \Rightarrow \alpha \in \underline{IV}$ чверт $\Rightarrow$

$\Rightarrow \sin\alpha < 0,\ \cos\alpha > 0,\ tg\alpha < 0,\ ctg\alpha < 0$

Задача 35

а) $\sin 25^\circ$: $0^\circ < 25^\circ < 90^\circ \Rightarrow 25^\circ \in \underline{I}$ чверт $\Rightarrow$

$\Rightarrow \sin 25^\circ > 0$

б) $\cos(-38^\circ)$: $-38^\circ \in \underline{IV}$ чверт $\Rightarrow \cos(-38^\circ) > 0$

в) $tg\frac{7\pi}{8} = tg\,0{,}875\pi \in \underline{II}$ чверт $\Rightarrow tg\frac{7\pi}{8} < 0$

г) $ctg\,210^\circ \in \underline{III}$ чверт $\Rightarrow ctg\,210^\circ < 0$

д) $ctg\frac{18\pi}{7} \approx 2{,}57\pi = 0{,}57\pi + 2\pi \in \underline{I}$ чверт $\Rightarrow$

$\Rightarrow ctg\frac{18}{7}\pi < 0$

ж) $\cos 13{,}6\pi = \cos(6\cdot 2\pi + 1{,}6\pi) > 0$

№ 36

а) $\sin 89^\circ \cdot \cos 390^\circ > 0$

б) $\sin 89^\circ \cdot \operatorname{tg} 91^\circ < 0$

в) $\cos\frac{\pi}{10} \cdot \sin\frac{7\pi}{3} > 0$

г) $\sin 122^\circ \cdot \cos 390^\circ > 0$

д) $\operatorname{tg} 19^\circ \cdot \cos 119^\circ < 0$

е) $\cos\frac{11\pi}{5} \cdot \operatorname{tg}\frac{5\pi}{11} > 0$

ё) $\operatorname{ctg}\frac{7\pi}{8} \cdot \sin\frac{8\pi}{7} > 0$

№ 37.

а) $(2 - \sin 112^\circ)\cos\frac{9}{8}\pi$

$\left(2 = \frac{200}{314}\pi \approx \frac{100}{157}\pi \approx 0{,}6\pi \in$ II чет $\right)$

$\sin 112^\circ > 0$

$0{,}6\pi + \sin 112^\circ > 0$

$\left(\sin 112^\circ \approx \frac{\sqrt{3}}{2}\right)$

Так как $\sin\alpha$ определен $\forall$ действительных

$-1 \le \sin\alpha \le 1$, то $\sin 112^\circ < 2$, следовательно

$2 - \sin 112^\circ > 0$

$\cos\frac{9}{8}\pi \approx \cos 1{,}12\pi \in$ III чет $\Rightarrow$

$\Rightarrow \cos 1{,}12\pi < 0$

$$\begin{cases} 2-\sin 112^\circ > 0 \\ \cos\frac{9}{8}\pi < 0 \end{cases} \Leftrightarrow (2-\sin 112^\circ)\cos\frac{9}{8}\pi < 0$$

ж) $(\cos 25^\circ - 3)\operatorname{ctg} 132^\circ > 0$

Умн № 38

ш) $\sin(-30^\circ) = -0{,}5$

ф) $\cos\left(-\frac{\pi}{3}\right) = 0{,}5$

ч) $\operatorname{tg}\left(-\frac{\pi}{4}\right) = -1$

ц) $\operatorname{tg}\left(-\frac{5\pi}{6}\right) = \frac{\sqrt{3}}{3}$

х) $\operatorname{ctg}(-135^\circ) = 1$

ч) $\operatorname{ctg}\left(-\frac{2\pi}{3}\right) = \frac{\sqrt{3}}{3}$

Умн № 39

ш) $\alpha = \frac{25\pi}{6} = \frac{\pi}{6} + 2\cdot 2\pi = 30^\circ$

$\sin 30^\circ = \frac{1}{2}$ $\cos 30^\circ = \frac{\sqrt{3}}{2}$ $\operatorname{tg} 30^\circ = \frac{\sqrt{3}}{3}$ $\operatorname{ctg} 30^\circ = \sqrt{3}$

ф) $\alpha = 840^\circ = 120^\circ + 2\cdot 360^\circ$

$\sin 120^\circ = \frac{\sqrt{3}}{2}$ $\cos 120^\circ = -\frac{1}{2}$ $\operatorname{tg} 120^\circ = -\sqrt{3}$, $\operatorname{ctg} = -\frac{\sqrt{3}}{3}$

ч) $\alpha = -420^\circ = 300 - 2\cdot 360^\circ$

$\sin 300^\circ = -\frac{\sqrt{3}}{2}$ $\cos 300^\circ = 0{,}5$; $\operatorname{tg} 300^\circ = -\sqrt{3}$ $\operatorname{ctg} 300^\circ = \frac{\sqrt{3}}{3}$

7) $\alpha = -\frac{3\pi}{4} = -0{,}75\pi = 1{,}25\pi - 2\pi = 225^\circ$

$\sin 225^\circ = -\frac{\sqrt{2}}{2}$, $\cos 225^\circ = -\frac{\sqrt{2}}{2}$, $tg\,45^\circ = 1$, $ctg\,45^\circ = 1$

6) $\alpha = \frac{7\pi}{6} = 1{,}16\pi = 210^\circ$

$\sin 210^\circ = -0{,}5$, $\cos 210^\circ = -\frac{\sqrt{3}}{2}$, $tg\,210^\circ = \frac{\sqrt{3}}{3}$

$ctg\,210^\circ = \sqrt{3}$

4) $\alpha = \frac{11\pi}{4} = 2{,}75\pi = 0{,}75\pi + 2\pi = 135^\circ$

$\sin 135^\circ = \frac{\sqrt{2}}{2}$, $\cos 135^\circ = -\frac{\sqrt{2}}{2}$, $tg\,135^\circ = -1$, $ctg\,135^\circ = -1$

Ұшыд 40

ш) $\frac{ctg^2\frac{5\pi}{6} - 2\sin\frac{2\pi}{3}}{tg\frac{\pi}{3} + \sqrt{2}\cos\frac{3\pi}{4}} = \frac{3-\sqrt{3}}{\sqrt{3}+1} = \frac{\sqrt{3}(\sqrt{3}-1)}{\sqrt{3}-1} = \sqrt{3}$

1) $ctg^2\frac{5\pi}{6} = 3$

2) $2\sin\frac{2\pi}{3} = \sqrt{3}$

3) $tg\frac{\pi}{3} = \sqrt{3}$

4) $\sqrt{2}\cos\frac{3\pi}{4} = -1$

е) $$\frac{2\cos^2(-\pi)+\sqrt{2}\,tg\left(-\frac{2\pi}{3}\right)}{\sin^2\left(-\frac{\pi}{2}\right)-\sqrt{3}\sin\left(-\frac{\pi}{4}\right)}=\frac{2+\sqrt{6}}{1+\frac{\sqrt{6}}{2}}=\frac{\sqrt{2}(\sqrt{2}+\sqrt{3})}{\sqrt{2}(\sqrt{2}+\sqrt{3})}\cdot\frac{2}{}=$$

1) $2\cos^2(-\pi)=2$ $\quad =2$

2) $\sqrt{2}\,tg\left(-\frac{2\pi}{3}\right)=\sqrt{2}\cdot\sqrt{3}=\sqrt{6}$

3) $\sin^2\left(-\frac{\pi}{2}\right)=1$

4) $\sqrt{3}\sin\left(-\frac{\pi}{4}\right)=-\frac{\sqrt{6}}{2}$

Ответ: 2.

2/ирд 45.

ш) $\sqrt{11-6\sqrt{2}}+\sqrt{11+6\sqrt{2}}=6$

$11-6\sqrt{2}+11+6\sqrt{2}+2\sqrt{(11-6\sqrt{2})(11-6\sqrt{2})}=36$

$22+2\sqrt{121-72}=36$

$22+2\cdot\sqrt{49}=36$

$36=36$

л) $\sqrt{3-2\sqrt{2}}-\sqrt{3+2\sqrt{2}}=-2$

$3-2\sqrt{2}+3+2\sqrt{2}-2\sqrt{(3-2\sqrt{2})(3+2\sqrt{2})}=4$

$6-2\sqrt{9-8}=4$

$4=4$

2/шуд 42

ш) Ауғаты. $\sqrt{(a+15)(6-a)}$, бұл $\sqrt{a+15}+\sqrt{6-a}=5$

$\sqrt{a+15}+\sqrt{6-a}=5$ рше $a<6$

$a+15+6-a+2\sqrt{(a+15)(6-a)}=25$

$21+2\sqrt{(a+15)(6-a)}=25$

$\sqrt{(a+15)(6-a)}=4$

$(a+15)(6-a)=16$

$6a-a^2+90-15a=16$

$a^2+9a-74=0$

$D=81+296=377$

$a_{1;2}=\frac{-9\pm\sqrt{377}}{2}$ / $\frac{\sqrt{377}-9}{2}$; $\frac{\sqrt{377}+9}{2}$

г) Ауғаты $\sqrt{25-a}+\sqrt{9-a}$, бұл $\sqrt{25-a}-\sqrt{9-a}=2$

$(\sqrt{25-a}-\sqrt{9-a})^2=4$

$(\sqrt{25-a})^2+(\sqrt{9-a})^2-2\sqrt{(25-a)(9-a)}=16$

$25-a+9-a-2\sqrt{(25-a)(9-a)}=16$

$34-2a-2\sqrt{(a-25)(a-9)}=16$

$\sqrt{5-a}$ ⇒ $\sqrt{25-a}+\sqrt{9-a} = \frac{(\sqrt{25-a}+\sqrt{9-a})(\sqrt{25-a}-\sqrt{9-a})}{2(\sqrt{25-a}-\sqrt{9-a})} =$

$a<6$

$= \frac{25-a-9+a}{2} = 8$

Ответ: $\sqrt{25-a}+\sqrt{9-a}=8$

а) Найти a^2+a^{-2}, если $a-\frac{1}{a}=4$

$a-\frac{1}{a} = a-a^{-1}=4$

$(a-a^{-1})^2 = 4^2 16$

$a^2+a^{-2}-2a\cdot a^{-1} = 4^2 16$

$a^2+a^{-2}=18$

Ответ: $a^2+a^{-2}=18$

г) $(3a)^3 + 27a^3+64a^{-3}$, если $3a+4a^{-1}=8$

$(3a+4a^{-1})^3 = 512$

$27a^3+64a^{-3}+3\cdot 9a^2\, 4a^{-1}+3\cdot 3a\cdot 16a^{-2}=512$

$27a^3+64a^{-3}=512+108a+144a^{-1}=512$

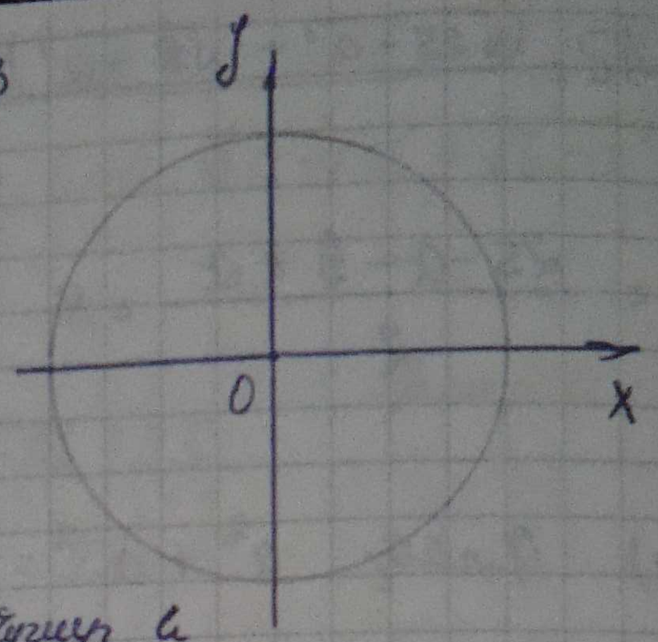
$27a^3+64a^{-3}+36(3a+4a^{-1}) = 512$

$27a^3+64a^{-3} = 512-36\cdot 8 = 8$

$27a^3+64a^{-3}=224$

Ответ: $27a^3+64a^{-3}=224$

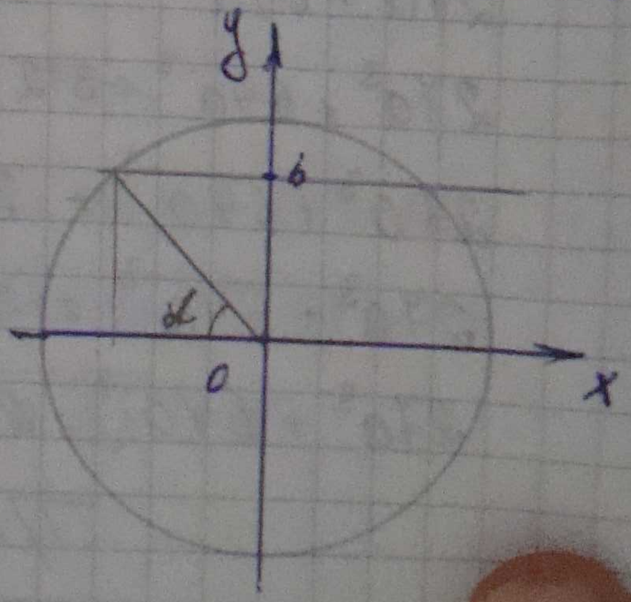
Նկար 43



Նկ., որ դանկաստյան հ անկյան սինուսը և կոսինուսը միանշանակ կրո նել չենք կարող:

Երբ, որևէ անկյան սինուսը և կոսինուսը միանշանակ օ-ի են համապատասխանում այդ անկյան մեկ(որ ՕՀ առանցքի հետ կազմում է հ անկյունը) շրջանագծի հետ հատման կետի կոորդինատներին համապատասխանում է (0;0)-ն:
Հայտ շրջանագծի օ կենտրոնով կոորդինատական առանցքներ են, որոնք շրջանագծի հետ հատման կետ են տալիս, ապա այդ կոորդինատական առանցքների և շրջանագծի հատման կետերի կոորդինատները միանշանակ են որոշում հ անկյունը:

Նկար 44



$|b| \le 1 \Rightarrow 0 \le |b| \le 1$

$y = b \qquad -1 \le b \le 1$

b-ն y առանցքի կետ է

$\sin\lambda = b$

$-1 \le \sin\alpha \le 1$

$-1 \le b \le 1$

$\sin\alpha = b$

b-ի յուրաքանչյուր արժեքին համապատասխանում է անվերջ քանակությամբ α անկյուններ ($0^\circ \le \alpha \le 180^\circ$):

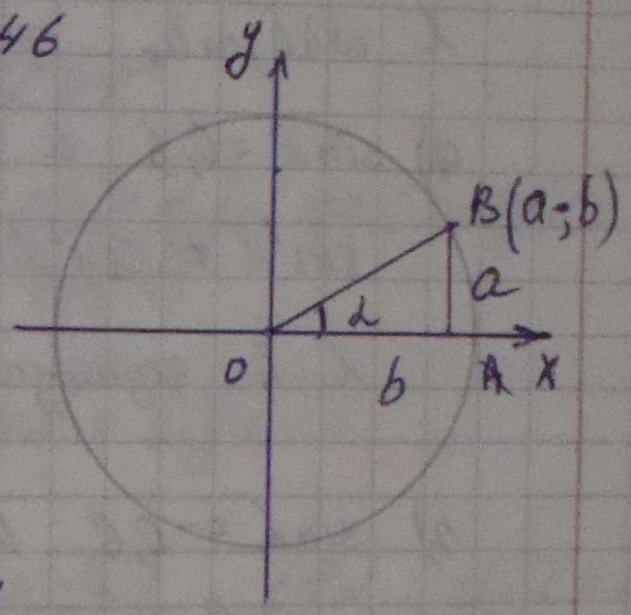
Հետևում է.

$|b| \le 1$

$-1 \le b \le 1$

Հետևում է 46

Պահանջվում է ապացուցել, որ եթե $a^2+b^2=1$, ապա գոյություն ունի միակ սուր անկյուն α, որ $\sin\alpha = a$ և $\cos\alpha = b$:



Ապացույց. որ $a^2+b^2=1$, ապա $0 \le a^2 \le 1$, $0 \le b^2 \le 1$, ինչպես որ $-1 \le a \le 1$ և $-1 \le b \le 1$ ⇒ որ եթե դիտարկենք շրջանագիծ և կոորդինատական հարթություն, a-ն կարող է գրաֆիկ Oy առանցքի վրա: Իսկ b-ն Ox առանցքի վրա: Այդ դեպքում, եթե շրջանագծի վրա վերցնենք որ. B կետը, ապա նրա կոորդինատները կլինեն $(b;a)$, այսինքն $\sin\alpha = a$, $\cos\alpha = b$:

Задача 47.

а) Дано $\sin\alpha = 0,4$ и $\cos\alpha = 0,4$, значит

$\sin^2\alpha + \cos^2\alpha = 2\,0,4^2 = 0,32$, что быть

не может, значит такого угла не бывает.

б) $\sin\alpha = 0,3$ и $\cos\alpha = 0,7$.

$\sin^2\alpha + \cos^2\alpha = 1$.

$0,3^2 + 0,7^2 = 0,09 + 0,49 = 0,58 \neq 1$

α такого угла не бывает.

г) $\sin\alpha = 0,6$ и $\cos\alpha = 0,8$

$\sin^2\alpha + \cos^2\alpha = 0,36 + 0,64 = 1$

α - такого угла есть.

д) $\sin\alpha = -0,6$ и $\cos\alpha = 0,8$

$\sin^2\alpha + \cos^2\alpha = 1$

α - такого угла есть.

Задача 48

Доказать основные тригонометрические тождества

$\operatorname{tg}\alpha = \frac{\sin\alpha}{\cos\alpha}$ (1) $\operatorname{tg}\alpha \cdot \operatorname{ctg}\alpha = 1$ (3)

$\sin^2\alpha + \cos^2\alpha = 1$ (4)

$\operatorname{ctg}\alpha = \frac{\cos\alpha}{\sin\alpha}$ (2)

$1 + ctg^2\alpha = \frac{1}{\sin^2\alpha}$ (5) $\quad tg^2\alpha + 1 = \frac{1}{\cos^2\alpha}$ (6)

ш) $1 - \cos^2\alpha = \sin^2\alpha$

ф) $\frac{1}{\cos^2\alpha} - 1 = tg^2\alpha$

ч) $tg\alpha \cdot ctg\alpha + ctg^2\alpha = 1 + ctg^2\alpha = \frac{1}{\sin^2\alpha}$

ц) $tg\beta ctg\beta + tg^2\beta = 1 + tg^2\beta = \frac{1}{\cos^2\beta}$

х) $\sin^2\alpha - 1 = -\cos^2\alpha$

ц) $(1-\sin\alpha)(1+\sin\alpha) = \cos^2\alpha$

2/ш.т 49

ш) $\frac{\sin\alpha - \sin^3\alpha}{\cos\alpha - \cos^3\alpha} = \frac{\sin\alpha\,(1-\sin^2\alpha)}{\cos\alpha\,(1-\cos^2\alpha)} = tg\alpha \cdot ctg^2\alpha =$

$= tg\alpha \cdot ctg\alpha \cdot ctg\alpha = 1\, ctg\alpha = ctg\alpha$

ф) $\frac{\sin^3\alpha - \sin^5\alpha}{\cos^3\alpha - \cos^5\alpha} = \frac{\sin^3\alpha\,(1-\sin^2\alpha)}{\cos^3\alpha\,(1-\cos^2\alpha)} = tg^3\alpha \cdot ctg^2\alpha = tg\alpha$

ч) $\frac{tg\alpha\, ctg\alpha - \cos^2\alpha}{\sin\alpha} = \frac{1-\cos^2\alpha}{\sin\alpha} = \sin\alpha$ ~~$- ctg\alpha \cdot \cos\alpha$~~

$= -\sqrt{\frac{1}{\sin^2\alpha} - 1} \cdot \cos\alpha = -\sqrt{\frac{1-\sin^2\alpha}{\sin^2\alpha}}\ \cos\alpha =$

$= -\frac{\sqrt{\cos^2\alpha}}{\sqrt{\sin^2\alpha}} =$

з) $\frac{1-\cos^2\alpha}{1-\sin^2\alpha} + tg\alpha\, ctg\alpha = tg^2\alpha + 1 = \frac{1}{\cos^2\alpha}$

№ 50

ш) $\frac{tg\beta\, ctg\beta - \sin^2\beta}{ctg\beta} = \frac{\cos^2\beta}{ctg\beta} = \sin\beta\cdot\cos\beta$

ґ) $\cos^2\beta(1+tg^2\beta) - \sin^2\beta = \cos^2\beta$

ґ) $ctg^2\alpha + (1+tg^2\alpha)\cos^2\alpha = \frac{1}{\sin^2\alpha}$

з) $\cos^2\alpha\left(\frac{tg\alpha}{ctg\alpha} + 1\right) + tg^2\alpha = \cos^2\alpha\left(\frac{\sin^2\alpha+\cos^2\alpha}{\cos^2\alpha}\right) + tg$

$= \cos^2\alpha\, 1 + tg^2\alpha = \frac{1}{\cos^2\alpha}$

Знач., при цих умовах вирази набувають 25 α-ну

№ 51

р.в.г. $0 \le \alpha \le 2\pi$

ш) $\frac{\sin^2\alpha - \cos^2\alpha + 1}{\sin^2\alpha} = \frac{2\sin^2\alpha}{\sin^2\alpha} = 2$

р.в.г

ґ) $\frac{\cos^4\alpha - \sin^4\alpha}{\sin^2\alpha - \cos^2\alpha} =$

р.в.г $\sin^2\alpha - \cos^2\alpha \neq 0$

$1 - 2\cos^2\alpha \neq 0$

$\cos^2\alpha \neq \frac{1}{2}$

$\cos\alpha \neq \pm\frac{\sqrt{2}}{2}$

$\sin\alpha \neq \mp\frac{\sqrt{2}}{2}$

$= \frac{(1-\sin^2\alpha)^2 - \sin^4\alpha}{\sin^2\alpha - 1 + 2\cos^2\alpha} =$

$\sin^2\alpha - 1 + \sin^2\alpha$

$$= \frac{1+\sin^4\alpha-2\sin^2\alpha-\sin^4\alpha}{2\sin^2\alpha-1} = \frac{1-2\sin^2\alpha}{-(1-2\sin^2\alpha)} = -1$$

q) $(\cos\alpha+\sin\alpha)^2-2\sin\alpha\cos\alpha =$ p.w.ł $0\le\alpha\le2\pi$

$= \cos^2\alpha+\sin^2\alpha+2\cos\alpha\sin\alpha-2\sin\alpha\cos\alpha =$

$= 1$

ğ) $\sin^4\alpha+\cos^4\alpha+2\sin^2\alpha\cos^2\alpha = (\sin^2\alpha+\cos^2\alpha)^2 = 1$ p.w.ł $0\le\alpha\le2\pi$

2/шр б 53

Өнің қатынастарды

ш) $(\sin\beta-\cos\beta)^2+(\sin\beta+\cos\beta)^2=2$

$\sin^2\beta+\cos^2\beta-2\sin\beta\cos\beta+\sin^2\beta+\cos^2\beta+2\sin\beta\cos\beta=2$

$2(\sin^2\beta+\cos^2\beta)=2$

$2=2$

ғ) $(\operatorname{tg}\alpha+\operatorname{ctg}\alpha)^2-(\operatorname{tg}\alpha-\operatorname{ctg}\alpha)^2=4$

$\operatorname{tg}^2\alpha+\operatorname{ctg}^2\alpha+2\operatorname{tg}\alpha\operatorname{ctg}\alpha-\operatorname{tg}^2\alpha-\operatorname{ctg}^2\alpha+2\operatorname{tg}\alpha\operatorname{ctg}\alpha=4$

$4\operatorname{tg}\alpha\operatorname{ctg}\alpha=4$

$4=4$

q) $\frac{\cos\alpha}{1+\sin\alpha}+\operatorname{tg}\alpha = \frac{1}{\cos\alpha}$

$\frac{\cos\alpha}{1+\sin\alpha}+\frac{\sin\alpha}{\cos\alpha} = \frac{\cos^2\alpha+\sin\alpha+\sin^2\alpha}{\cos\alpha(1+\sin\alpha)} = \frac{1+\sin\alpha}{\cos\alpha(1+\sin\alpha)} =$

$= \frac{1}{\cos\alpha}$

г) $\dfrac{tg^2x-1}{tg^2x+1}+\cos^2x = \sin^2x$

$\left(\dfrac{1}{\cos^2x}-2\right)\cdot\cos^2x+\cos^2x =$

$= \cos^2x\left(\dfrac{1}{\cos^2x}-2+1\right) = \cos^2x\cdot tg^2x =$

$= \cos^2x\cdot\dfrac{\sin^2x}{\cos^2x} = \sin^2x$

2/ward 54

ш) $\dfrac{\sin^3x+\cos^3x}{\cos x+\sin x}-\sin x\cos x = (\cos x-\sin x)^2$

$\dfrac{\sin x(1-\cos^2x)+\cos^3x}{\cos x+\sin x}-\sin x\cos x =$

$= \dfrac{\sin x-\cos^2x(\sin x-\cos x)}{\cos x+\sin x}-\sin x\cos x =$

$= \dfrac{(\sin x+\cos x)(\sin^2x-\sin x\cos x+\cos^2x)}{\cos x+\sin x}-\sin x\cos x =$

$= \dfrac{(\sin x+\cos x)(1-\sin x\cos x)}{\cos x+\sin x}-\sin x\cos x =$

$= 1-2\sin x\cos x$

$= \sin^2 x + \cos^2 x - 2\sin x \cos x = (\sin x - \cos x)^2$

г) $\dfrac{\cos^3 x - \sin^3 x}{\cos x - \sin x} - \sin x \cos x = 1$

$\cos^2 x + \sin x \cos x + \sin^2 x - \sin x \cos x = \cos^2 x + \sin^2 x = 1$

д) $\dfrac{1 - 2\sin z \cos z}{\sin z - \cos z} = \sin z - \cos z$

$\dfrac{1 - 2\sin z \cos z}{\sin z - \cos z} = \dfrac{(\sin z - \cos z)^2}{\sin z - \cos z} = \sin z - \cos z$

е) $\cos\alpha = 0{,}8$; $\alpha \in$ IV четв

$\sin^2\alpha = 1 - \cos^2\alpha = 1 - 0{,}64 = 0{,}36$

$\sin\alpha = -0{,}6$

$tg\alpha = \dfrac{\sin\alpha}{\cos\alpha} = -\dfrac{0{,}6}{0{,}8} = -0{,}75 = -\dfrac{3}{4}$

$ctg\alpha = -\dfrac{4}{3}$

ж) $\sin\alpha = \dfrac{5}{13}$, $\alpha \in$ II четв.

$\cos^2\alpha = 1 - \dfrac{25}{169} = \dfrac{169 - 25}{169} = \dfrac{144}{169}$

$\cos\alpha = -\dfrac{12}{13}$

$$tg\alpha = \frac{\sin\alpha}{\cos\alpha} = -\frac{5}{13} \cdot \frac{13}{12} = -\frac{5}{12}$$

$$ctg\alpha = -\frac{12}{5} = -2,4$$

a) $tg\alpha = 0,75$; $\alpha \in$ III ćwiartka

$$\cos^2\alpha = \sqrt{\frac{1}{1+tg^2\alpha}} = \frac{1}{\sqrt{\frac{7}{4}}} = -\frac{2}{\sqrt{7}} = -\frac{2\sqrt{7}}{7}$$

$$\sin\alpha = \sqrt{1 - \frac{28}{49}} = -\sqrt{\frac{21}{49}} = -\sqrt{\frac{3}{7}}$$

$$ctg\alpha = \frac{4}{3}$$

$$\sin^2\alpha = \frac{1}{1+ctg^2\alpha} = \frac{1}{1+\frac{16}{9}} = \frac{9}{25}$$

$$\cos^2\alpha = 1 - \sin^2\alpha = 1 - \frac{9}{25} = \frac{16}{25}$$

$$\sin\alpha = -\frac{3}{5}$$

$$\cos\alpha = -\frac{4}{5}$$

b) $ctg\alpha = \frac{7}{24}$; $\alpha \in$ I ćwiartka

$$tg\alpha = \frac{24}{7}$$

$$\sin^2\alpha = \frac{1}{1+ctg^2\alpha} = \frac{1}{1+\frac{49}{576}} = \frac{576}{625}$$

$$\cos^2\alpha = 1 - \sin^2\alpha = 1 - \frac{576}{625} = \frac{625-576}{625} = \frac{49}{625}$$

$$\sin\alpha = \frac{24}{25}$$

$$\cos\alpha = \frac{7}{25}$$

2 чверті $\cos < 0$

ще $\sin\alpha = \frac{9}{41}$ і $\frac{\pi}{2} < \alpha < \pi \Rightarrow \alpha \in$ II чверті.

Знайти $\cos\alpha$

$$\cos^2\alpha = 1 - \sin^2\alpha = 1 - \frac{81}{1681} = \frac{1600}{1681}$$

$$\cos\alpha = -\frac{40}{41}$$

г) $\cos\alpha = \frac{8}{17}$ і $-\frac{\pi}{2} < \alpha < 0 \Rightarrow \alpha \in$ IV чверті

$tg\alpha - ?$

$$tg^2\alpha = \frac{1}{\cos^2\alpha} - 1 = \frac{17^2}{64} - 1 = \frac{289-64}{64} = \frac{225}{64}$$

$$tg\alpha = -\frac{15}{8} = -1{,}875$$

4) $\sin\alpha = -0{,}6$ и $-\pi < \alpha < -\frac{\pi}{2} \Rightarrow$ III четв

$\operatorname{ctg}\alpha - ?$

$$\operatorname{ctg}^2\alpha = \frac{1}{\sin^2\alpha} - 1 = \frac{1}{0{,}36} - 1 = \frac{1-0{,}36}{0{,}36} = \frac{0{,}64}{0{,}36}$$

$$\operatorname{ctg}\alpha = \frac{0{,}8}{0{,}6} = \frac{4}{3}$$

7) $\sin\alpha = ?$

$\operatorname{tg}\alpha = -\frac{8}{15}$ и $-\frac{3\pi}{2} < \alpha < -\pi \Rightarrow \alpha \in$ II четв

$$\operatorname{ctg}\alpha = -\frac{15}{8}$$

$$\sin^2\alpha = \frac{1}{1+\operatorname{ctg}^2\alpha} = \frac{1}{1+\frac{225}{64}} = \frac{64}{289}$$

$$\sin\alpha = \frac{8}{17}$$

Задача 57

ш) $\frac{7}{\sqrt{40}}\sin\alpha - ?$ $\quad \cos\alpha = -\frac{3}{7}$ и $3\pi < \alpha < \frac{7\pi}{2}$

$\pi < \alpha < \frac{3\pi}{2} \Rightarrow \alpha \in$ III четв

$$\sin^2\alpha = 1 - \cos^2\alpha = 1 - \frac{9}{49} =$$

$$= \frac{40}{49} \Rightarrow \sin\alpha = -\frac{\sqrt{40}}{7}$$

$\frac{7}{\sqrt{40}}\ \sin\alpha = \frac{7}{\sqrt{40}} \cdot \left(-\frac{\sqrt{40}}{7}\right) = -1$

f) $\cos\alpha = -\frac{15}{17}$ и $\frac{9\pi}{2} < \alpha < 5\pi$

$\frac{\pi}{2} < \alpha < \pi \Rightarrow \alpha \in II$ чет

Ответ: $-15\,tg\alpha$

$tg^2\alpha = \frac{1}{\cos^2\alpha} - 1 = \frac{289}{225} - 1 = \frac{64}{225}$

$tg\alpha = -\frac{8}{15}$

$-15\,tg\alpha = 15 \cdot \frac{8}{15} = 8$

g) $\frac{15}{\sqrt{2}}\ \cos\alpha - ?$ $\sin\alpha = -\frac{1}{3}$ и $-3\pi < \alpha < -\frac{5\pi}{2}$

$-\pi < \alpha < -\frac{\pi}{2} \Rightarrow$

$\Rightarrow \alpha \in III$ чет.

$\cos^2\alpha = 1 - \sin^2\alpha = 1 - \frac{1}{9} = \frac{8}{9}$

$\cos\alpha = -\frac{\sqrt{8}}{3} = -\frac{2\sqrt{2}}{3}$

$-\frac{15^5}{\sqrt{2}} \cdot \frac{2\sqrt{2}}{3} = -10$

Ответ: $\frac{15}{\sqrt{2}}\cos\alpha = -10$.

z/сир/58

а) $\cos\alpha = \frac{12}{13}$ и $\frac{3}{2}\pi < \alpha < 2\pi \Rightarrow \alpha \in IV$ чет

Делаем $\frac{1+tg\alpha}{1+ctg\alpha}$

$$tg^2\alpha = \frac{1}{\cos^2\alpha} - 1 = \frac{169}{144} - 1 = \frac{169-144}{144} = \frac{25}{144}$$

$$tg\alpha = -\frac{5}{12} \Rightarrow ctg\alpha = -\frac{12}{5}$$

$$\frac{1+tg\alpha}{1+ctg\alpha} = \frac{1-\frac{5}{12}}{1-\frac{12}{5}} = -\frac{7}{12}\cdot\frac{5}{7} = -\frac{5}{12}$$

б) $\sin\alpha = \frac{4}{5}$ и $\frac{\pi}{2} < \alpha < \pi \Rightarrow \alpha \in II$ чет

$tg\alpha - ?$ $ctg\alpha - ?$

$$ctg^2\alpha = \frac{1}{\sin^2\alpha} - 1 = \frac{25}{16} - 1 = \frac{9}{16}$$

$$ctg\alpha = -\frac{3}{4}$$

$$tg\alpha = -\frac{4}{3}$$

$$\frac{2-3\operatorname{tg}\alpha}{3-2\operatorname{ctg}\alpha}=\frac{2+4}{3+1{,}5}=\frac{6}{4{,}5}=\frac{60}{45}=\frac{4}{3}$$

9) $\cos\alpha=-\frac{1}{3}$ и $\pi<\alpha<\frac{3\pi}{2}\Rightarrow\alpha\in$ III четв

$\operatorname{ctg}\alpha$ - ?

$$\operatorname{tg}^2\alpha=\frac{1}{\cos^2\alpha}-1=9-1=8$$

$$\operatorname{tg}\alpha=2\sqrt{2}$$

$$\operatorname{ctg}\alpha=\frac{1}{2\sqrt{2}}=\frac{\sqrt{2}}{4}$$

$$\frac{\cos\alpha+\operatorname{ctg}\alpha}{\operatorname{ctg}\alpha}=\frac{-\frac{1}{3}+\frac{\sqrt{2}}{4}}{\frac{\sqrt{2}}{4}}=\frac{3\sqrt{2}-4}{12}\cdot\frac{4}{\sqrt{2}}=$$

$$=\frac{\sqrt{2}(3-2\sqrt{2})}{\sqrt{2}}=3-2\sqrt{2}$$

2/4 հաշիվ

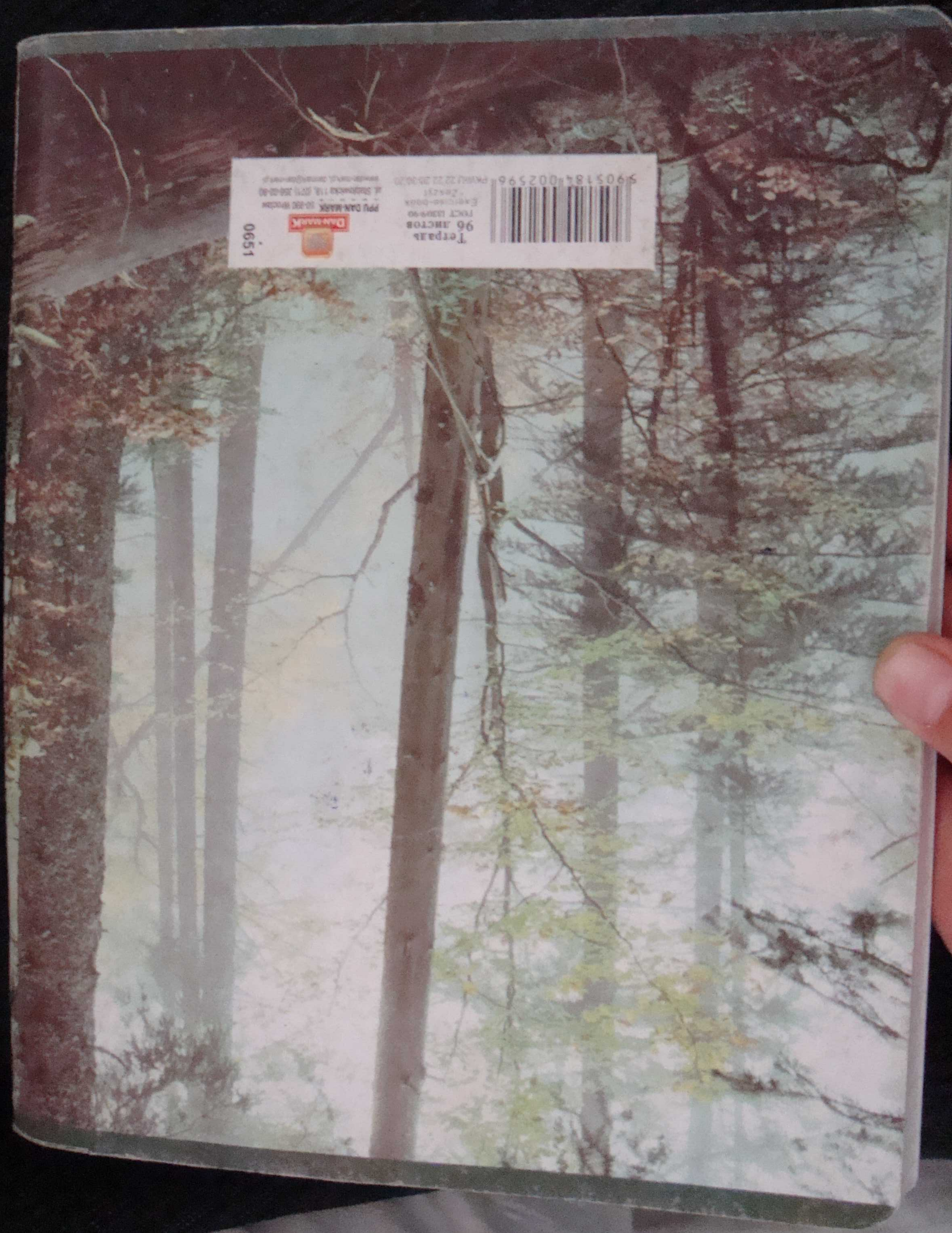
երեք 1/2 հիսուն 9 00

հինգ 1.2 տարեկան

հինգ տասնվեց

հինգ 1,2 տարեկան

Տարբեր 3,4 հիսուն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